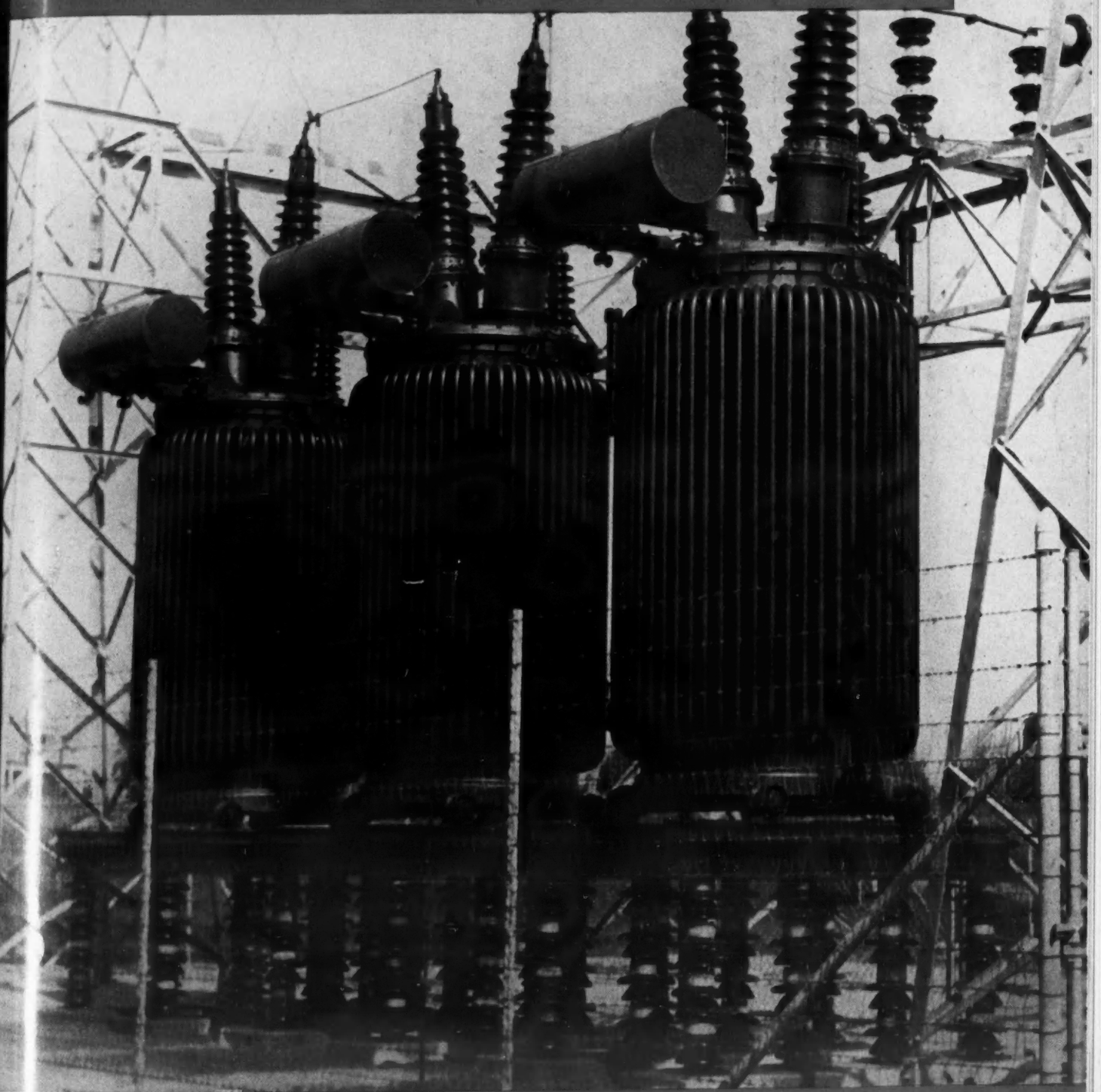
# Electrical World

APRIL 17, 1943



BOOSTER FOR UNORTHODOX TRANSMISSION LINE

# Lessen the THREAT of

# power flow INTERRUPTIONS!

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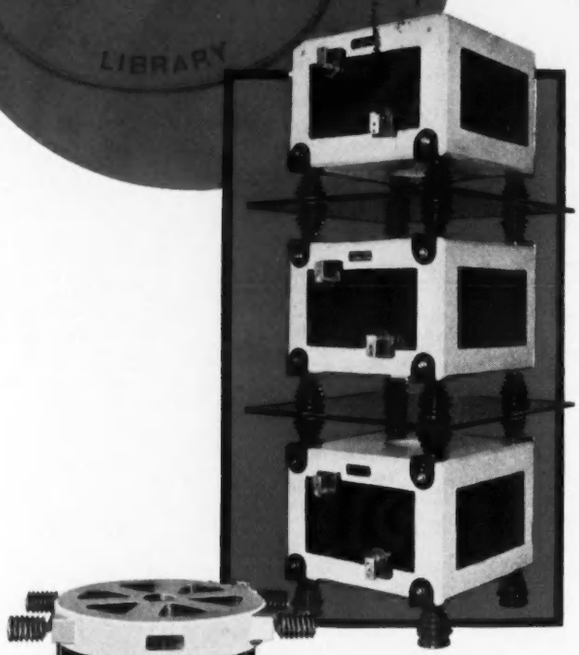

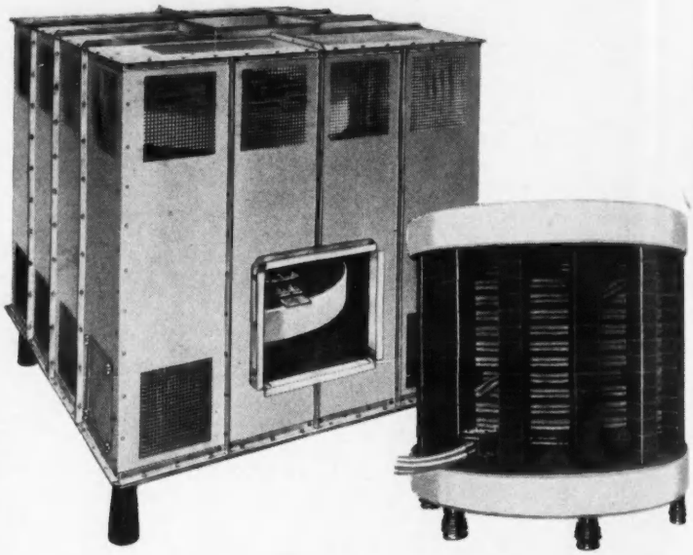

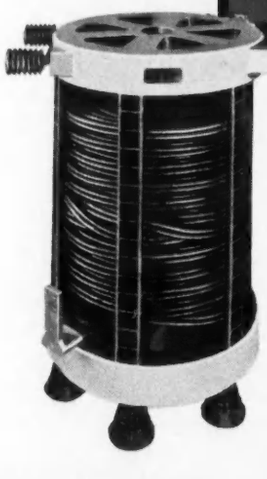

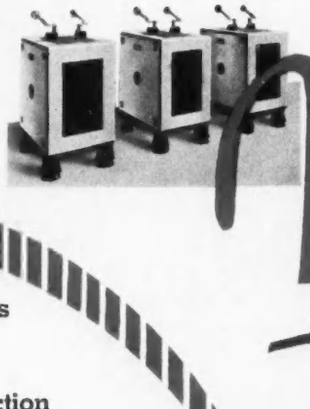

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All-Year Efficiencies

**HIGHEST**
Short Circuit Protection

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Temperature Rises

# Murray

—the foremost name on current-limiting

# REACTORS

# Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

April 17, 1943 Vol. 119, No. 16


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# Varnished Cambric Insulated Cables

Varnished cambric insulated wires and cables are ideally suited for numerous electrical applications.

The valuable information contained in this Bulletin should be in the hands of every man who has a part in installing, maintaining or buying insulated wires and cables for every electrical operation. It will tell him how varnished cabric insulated wires and cables will adequately and safely fill his requirements, and at the same time save critical war materials. A bound-in supplement gives consideration for increased loading under wartime conditions.

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Correction factors for segmental conductors, non-metallic conduit and d.c. ratings – Voltage drop tables – Conduit capacities – Splicing instructions – Terminating without potheads – Essential purchase data, etc.

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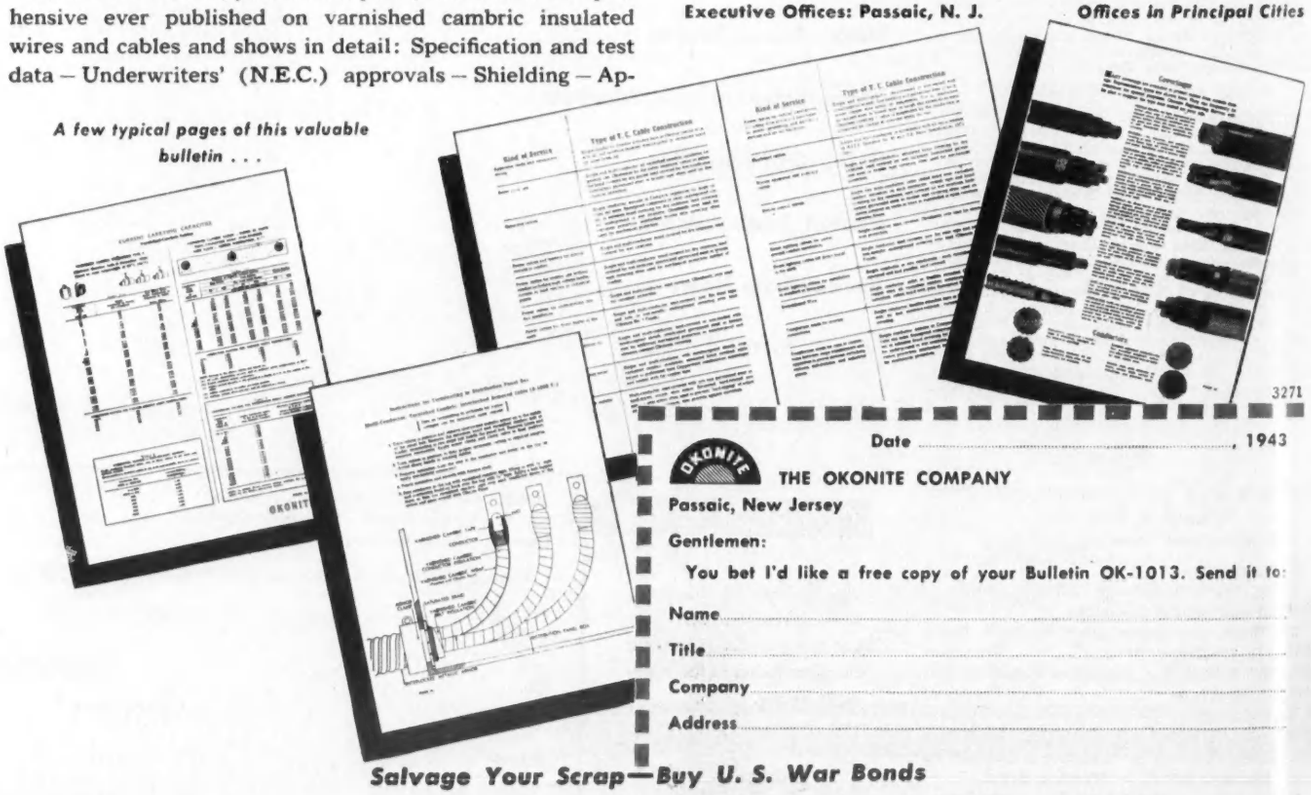
*A few typical pages of this valuable bulletin . . .*



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Date ....., 1943

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**Passaic, New Jersey**

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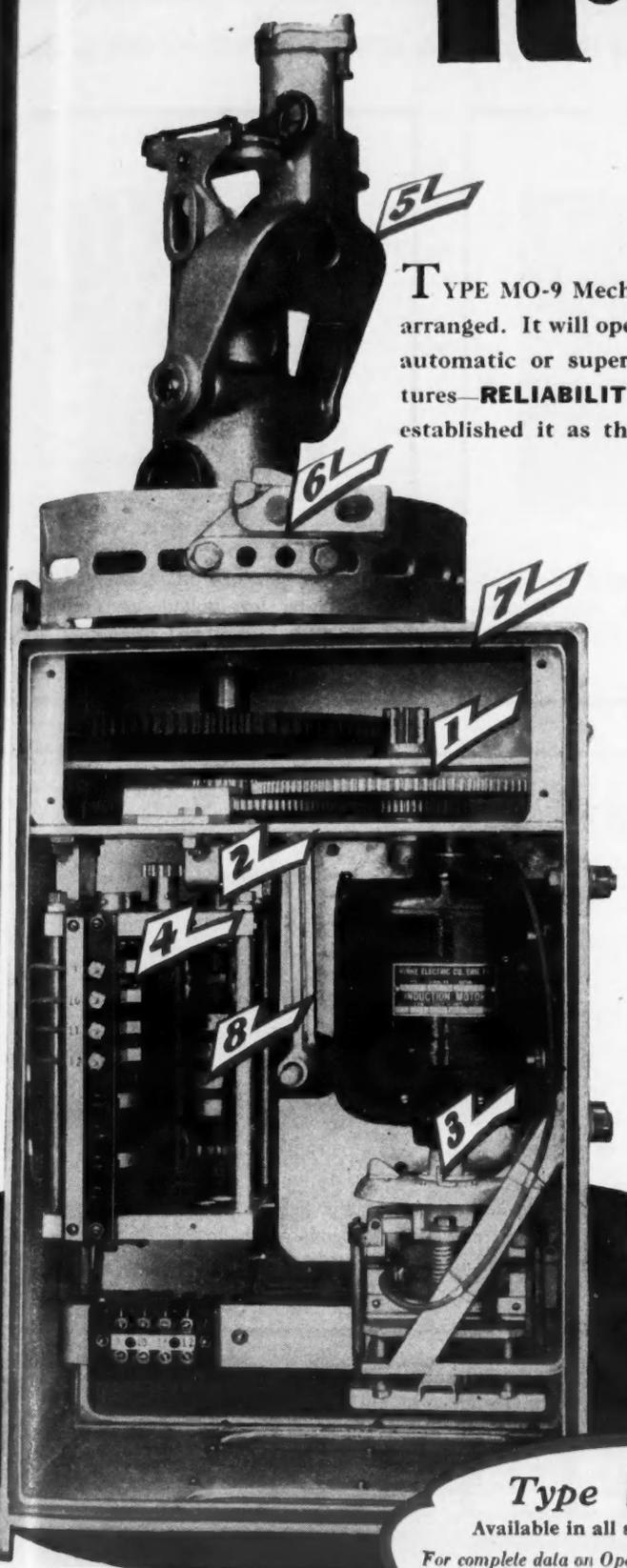



TYPE MO-9 Mechanism is simple, compact, and neatly arranged. It will operate any group switch, direct, indirect, automatic or supervisory controlled. These salient features—**RELIABILITY, SAFETY** and **CONVENIENCE** have established it as the outstanding motor mechanism.

## RELIABILITY

1. High efficiency, high torque motor drive, using.....
   Direct oiless spur gear train.
2. Chromium plated shafts with Oilite Bearings, provides maximum torque under all weather conditions.
3. Trouble-free operation insured by.....
   Oversize, direct acting brake, protected from oil or grease.
4. Silver contact, auxiliary switches.
   Vibration proof, mechanically interlocked contactors.
   Fusetron protected motor.

## SAFETY

Safe for hand operation.....

5. Manual handle automatically disconnects and recouples motor. Safe for inspection and test.
6. Provision for locking main switch open or closed.

## CONVENIENCE

7. Front, back, and gear case covers easily removable.
8. Adjustable auxiliary switch segments.

**Type MO-9**

**Available in all standard and special voltages.**

*For complete data on Operating Mechanisms, see Bulletin 1400.*

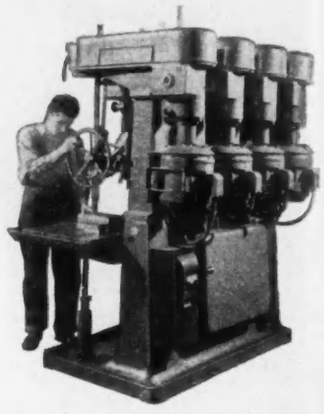
**RAILWAY AND INDUSTRIAL ENGINEERING COMPANY, GREENSBURG, PA.**

**IN CANADA—Eastern Power Devices, Ltd., Toronto**

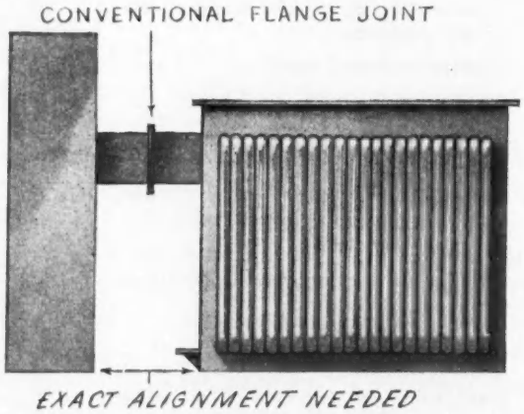
# Standardized

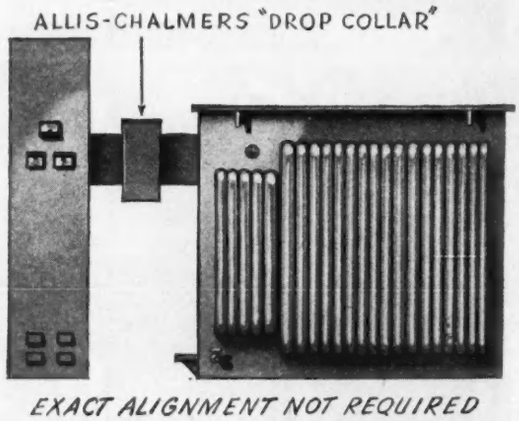
**New Allis-Chalmers Standard Load Center Unit Substation**
**They save installation time, save space, save losses... hel**

**Savings on Deliveries!** Because Allis-Chalmers Load Center Unit Substations have been standardized, there are no "specials" that hold up production by causing delays on the drafting board or in the shop. Yet these units are flexible to meet your exact requirements.



**Savings in Production!** Eliminating low voltage runs gives you lower losses, improved regulation, better motor and lamp performance in your plant.



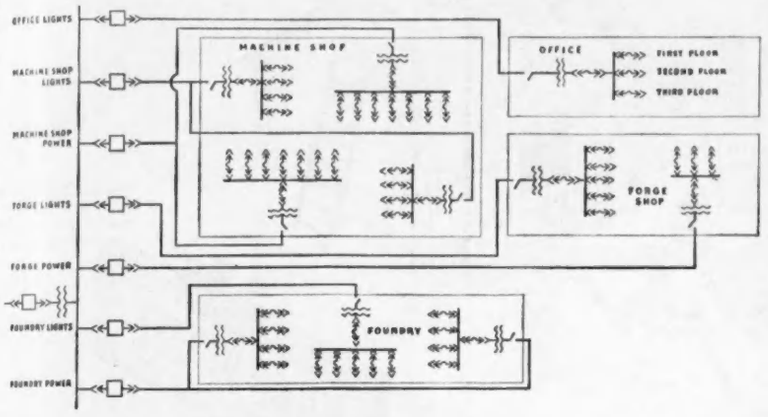




**Savings in Installation!** No exact alignment of the equipment is required. The Allis-Chalmers "drop collar" is used on outdoor and on the high side of load center units. On the low voltage side of load center units, flexible-cable connection is made inside switchgear cubicle. And because Allis-Chalmers Load Center Unit Substations are factory-assembled, there's no wiring to be done in the field. Nor is it necessary to construct any special foundation or fireproof vaults.

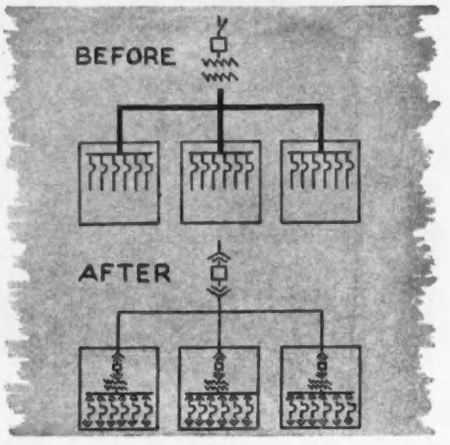
# ALLIS-CHALMERS

# for Savings!

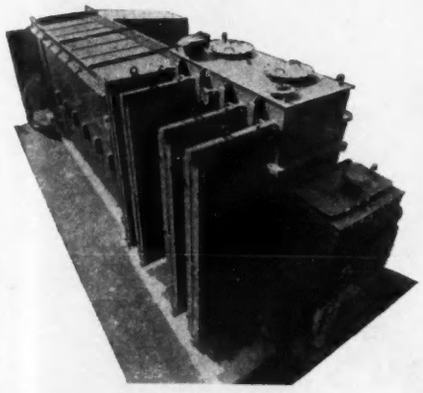
save drafting board delays, giving you faster deliveries.
you save important amounts of copper for the war effort!




**Savings During Blackouts!** Load Center Unit Substations make it easier to use separate lighting and power circuits. Lamp flicker is reduced . . . and blackout control of lighting can be achieved without killing power circuit and interrupting production.




**Savings in Copper!** Installed right at the machines they serve, load center unit substations eliminate long runs of heavy secondary cable.



**Savings in Space!** Compact design of Allis-Chalmers outdoor Unit Substations saves space. If load center shifts, these packaged units are easier to move.

## All this — and flexibility, too!

THE savings you make with standard Allis-Chalmers Load Center Unit Substations add up to a big wartime *and peacetime* engineering advantage. And there's no penalty attached...

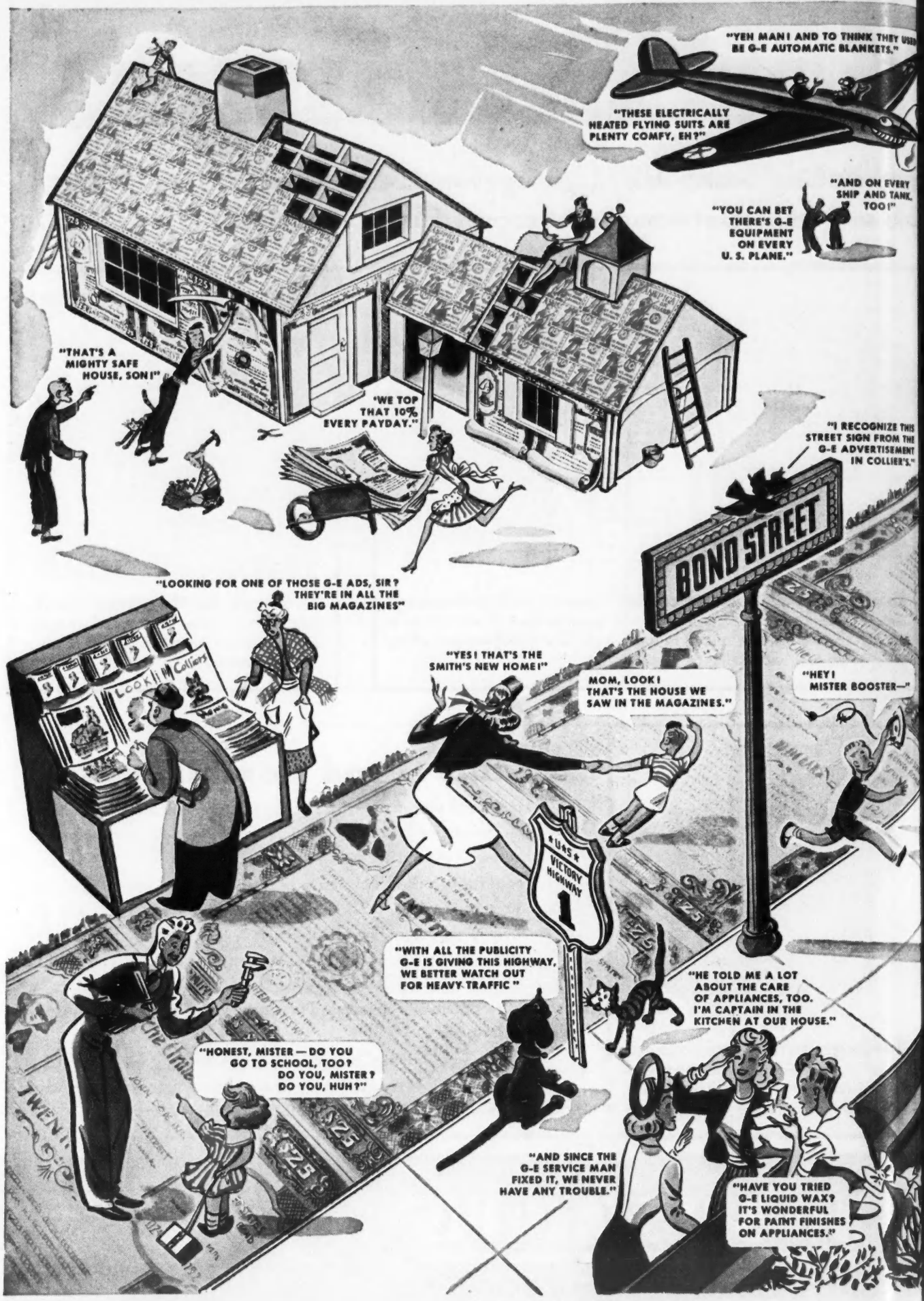
For even though these units have been standardized, you still get your choice of a wide variety of high and low voltage connection. On the high side you can have disconnect switches, oil fuse cutouts, metal-clad switchgear, direct connection to roof bushings, or throat connection to bus run. On the low side, stationary or drawout air breakers can be electrically or manually operated. Transformers can be Chlorextol-liquid-filled or dry-type.

To learn why buying Standard Load Center Unit Substations is smart buying for *you,* call the district office near you. Or write ALLIS-CHALMERS MFG. CO., MILWAUKEE, WIS.

A 1572

# UNIT SUBSTATIONS

WE WORK FOR VICTORY — WE PLAN FOR PEACE


"YEH MAN! AND TO THINK THEY USED TO BE G-E AUTOMATIC BLANKETS."
"THESE ELECTRICALLY HEATED FLYING SUITS ARE PLENTY COMFY, EH?"
"AND ON EVERY SHIP AND TANK, TOO!"
"YOU CAN BET THERE'S G-E EQUIPMENT ON EVERY U. S. PLANE."
"THAT'S A MIGHTY SAFE HOUSE, SON!"
"WE TOP THAT 10% EVERY PAYDAY."
"I RECOGNIZE THIS STREET SIGN FROM THE G-E ADVERTISEMENT IN COLLIER'S."
BOND STREET
"LOOKING FOR ONE OF THOSE G-E ADS, SIR? THEY'RE IN ALL THE BIG MAGAZINES"
Look
Colliers
"YES! THAT'S THE SMITH'S NEW HOME!"
MOM, LOOK! THAT'S THE HOUSE WE SAW IN THE MAGAZINES."
"HEY! MISTER BOOSTER—"
U.S.A.
VICTORY HIGHWAY
1
"WITH ALL THE PUBLICITY G-E IS GIVING THIS HIGHWAY, WE BETTER WATCH OUT FOR HEAVY TRAFFIC"
"HE TOLD ME A LOT ABOUT THE CARE OF APPLIANCES, TOO. I'M CAPTAIN IN THE KITCHEN AT OUR HOUSE."
"HONEST, MISTER — DO YOU GO TO SCHOOL, TOO? DO YOU, MISTER? DO YOU, HUH?"
"AND SINCE THE G-E SERVICE MAN FIXED IT, WE NEVER HAVE ANY TROUBLE."
"HAVE YOU TRIED G-E LIQUID WAX? IT'S WONDERFUL FOR PAINT FINISHES ON APPLIANCES."

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GENERAL ELECTRIC Presents
INTO THE WRINGER & OUT
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FREE to All G-E Appliance Retailers FREE
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"EXTRA! CLEVELAND AND ST. LOUIS OPEN NEW G-E SERVICE CENTERS."
WAR BONDS will build and equip NEW VICTORY HOMES tomorrow
BOOSTER BROS.
GENERAL ELECTRIC
IF WE CAN'T SELL YOU NEW ONES.. WE'LL FIX UP THE OLD ONES
WARTIME HELPS for Homemakers
U.S. MAIL
"MY WIFE SENT FOR SOME OF THESE BOOKLETS —AND SHE SAYS THEY SURE ARE HELPFUL."
'MINNIE GOT SOME TOO. SAYS G-E CONSUMERS INSTITUTE SURE KNOWS THE ANSWERS."
CONSUMERS INSTITUTE MAIL
"PROPER CARE OF ELECTRIC APPLIANCES IS JUST PLAIN HORSE SENSE!"
"I POSED FOR THIS ON MY LAST FURLOUGH."
"IT'S JUST LIKE YOU, JIM! AND EVERYBODY SAW IT IN LIFE AND THE POST MAGAZINES."
SCRAP is POWER
ROY CARLEY

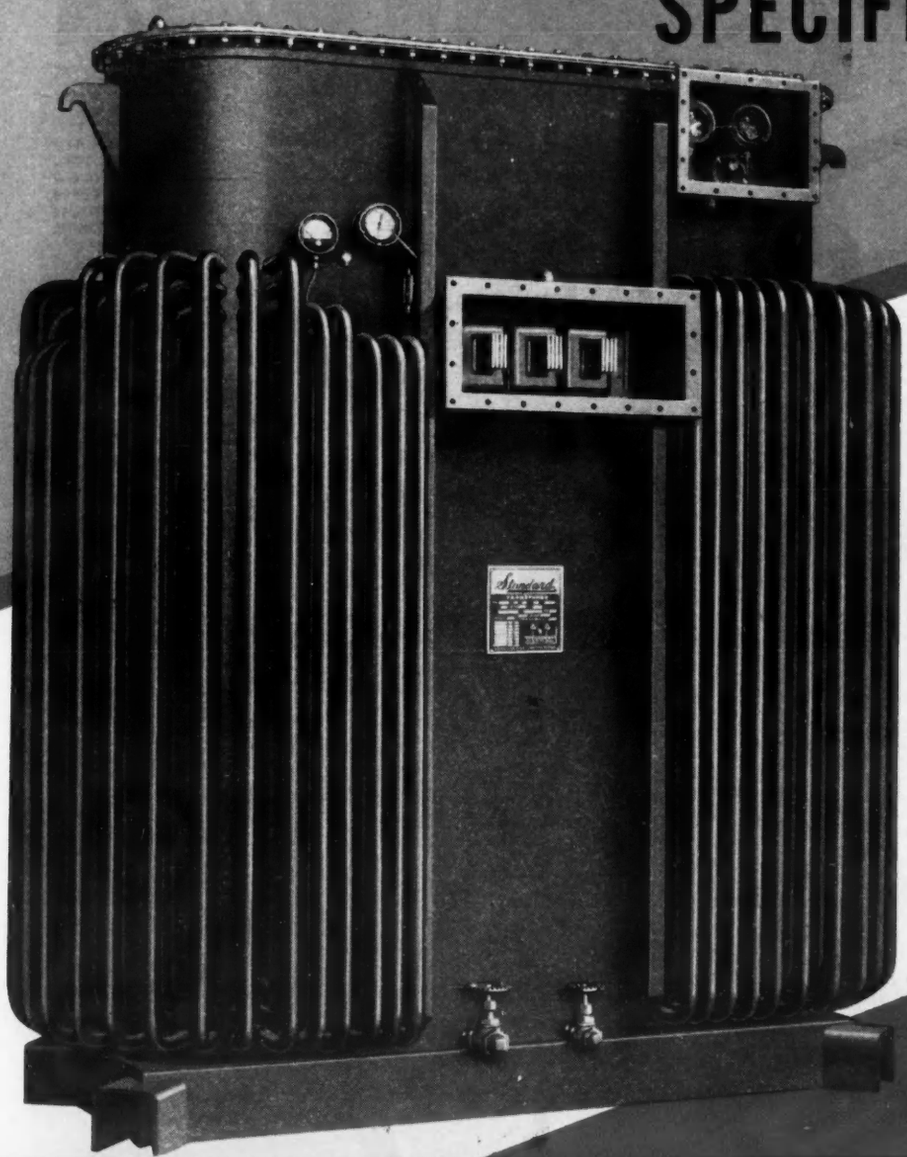
*Let operating conditions determine the type of transformer you require*

TRADE MARK

# *Standard*

## BUILDS THEM TO YOUR SPECIFICATIONS

*In...*



## ASKAREL

● 2500 KVA, Type HT, Askarel filled transformer. 60 cycle, three phase, 4160 V. delta primary with two 2½% taps above normal and two 2½% taps below normal. 460 V. delta secondary: complete with standard accessories winding temperature indicator, and magnetic oil gauge with low level alarm contacts.

## THE STANDARD TRANSFORMER

● When you buy a transformer—buy it to meet a specific operating condition. Standard Transformer engineers have found from experience that longer service—and ultimately lower costs are obtained when the transformer is designed and built to cover an individual condition.

Perhaps you can save long runs of secondary copper, improve machine efficiency in the plant by locating a transformer close to the load center, you decide an Askarel type transformer will do the job. Standard will build it.

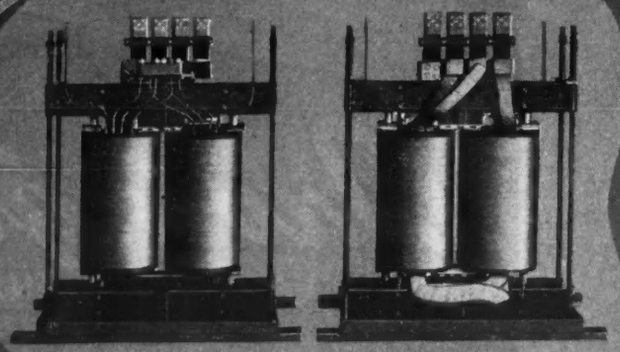
On the other hand, if floor space and safety regulations call for an air-cooled transformer,—Standard will build it to meet your specific need.

Our experience in the design and construction of all types of transformers—our modern manufacturing facilities—our complete engineering organization—enables us to move quickly and efficiently on all transformer requirements.

If you would like the help of one of our engineers in determining which type of transformer is best suited to your needs—write or wire Standard Transformer Company, Warren, Ohio.

# nd AIR COOLED TYPES...

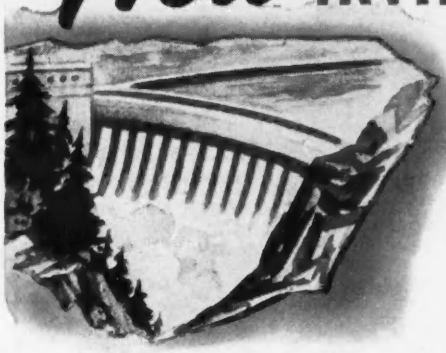
Shipment of 12 Type MG. 200 A. 300 KVA and 400 KVA dry pe, air cooled, natural draft, glass ulated transformers, 75 deg. C. e, 60 cycle, single phase, 4160 V mary 120/240 V. secondary. All e terminals are enclosed in term- al chambers when transformers e installed.



Core and coil structure, front and back view, of 400 KVA, Type MG, dry type, air cooled, natural draft, glass insulated transformer, 75 deg. C. rise, 60 cycle, single phase, 4160 V. primary, 120/240 V. secondary.

IEI OMPANY, *Warren, Ohio*

# *How* IRVINGTON-TAPED CABLE SPLICES



## HELPED GET POWER 3 MONTHS EARLIER!

The news story at the right speaks for itself. It reports how cable splicing sped power distribution to an area where shipbuilding and aircraft industries must be kept going full blast.

The story proves that when splices are wrapped with Irvington Varnished Cambric Tape, short cable lengths can be joined to serve in place of "not available" new cable. Irvington materials designed to aid in splicing are:

**Dry Packed Tape for Splicing Low Voltage Cable.** Cut from Seamless Bias Varnished Cambric, this tape is supplied in tightly wound rolls which are completely waxed to seal against moisture and air. The sealing prevents deterioration and maintains the dielectric strength of the tape during storage. This tape meets A.S.T.M. specifications.

**Oil-Immersed Tape for Splicing High Voltage Cable.** This tape has a low power factor which is maintained after the splice is made. The reason for this is the special processing which the tape undergoes in manufacturing and packaging. Not only does this processing maintain low power factor but it also preserves the tape's high dielectric strength. Oil-Immersed tape meets A.S.T.M. requirements.

**Cardolite No. 708 Cold-Setting Compound.** Used as a filling material within the lead sleeve over splices, this material is easy to handle because it does not require heating. It sets within two hours.

**Harvel Oil Stop.** This product, a phenol-formaldehyde synthetic resin, is used to make stop joints and for oil-tight splices on rubber to paper and paper to paper insulated cables. It is applied as a viscous liquid and polymerizes at ordinary temperatures into a firm, enduring, infusible insulation.

*For further information on these splicing materials, write Dept. 46.*

### Emergency Cable Has 17 Splices

When an opportunity to conserve fuel in southern California steam plants developed through the temporary rearrangement of Boulder Dam generators Southern California Edison Company engineers were presented with the problem of securing three 200-ft. lengths of 1,250,000-cir.-mil, 13.6-kv. cable for low-tension generator leads.

The cable was assembled from scrap lengths found on the system by making 17 silfos splices.

The situation came about when the transformer installation for Edison's A-5 82,500-kw. generator was completed three months before the generator was ready for operation. Metropolitan Water District, one of the contractors for Boulder power, had a similar unit which was not being used. This machine was on the Nevada side of the power house. However, the Los Angeles Bureau of Power and Light, operating machines on both sides of the plant, had units A-1 and A-2 on the Edison side. An agreement was made whereby Edison temporarily took over unit A-2 and the bureau took over the MWD machine. The problem then was temporarily to connect unit A-2 to the A-5 transformer bank.

Because new cable was not available, various lengths and sizes of 13.6-kv. cable were assembled and spliced into the necessary lengths. The silfos soldering technique evolved consisted of six steps: First, half sleeves were cut from i.p.s. copper pipe. The inside of the sleeves was coated with silfos. Next the cable ends were cut with a $\frac{3}{4}$-in. bevel and the insulation stripped back 12 in. from each end. The butts of the cable were coated with silfos.

A wide "vee" is necessary when the cable ends are joined together because the heat is carried off so rapidly that the torch tip must be worked down into the joint. Otherwise the soldering is too slow. In this step the cable ends are brought within $\frac{1}{4}$ in. of each other and silfos applied from the bottom of the "vee" upward, taking extreme care to bond solder to the cable in the building-up process. Next the bottom half-sleeve is applied, using care to see that silfos flows between cable and sleeve along all edges. The top half-sleeve is then applied in a similar manner. Approximately $\frac{1}{2}$ lb. of silfos is required for each joint.

Finally 0.010 x 1-in. Irvington tape is wrapped around the joint to build up insulation equivalent to the original. The splice is finished off with one layer of $1\frac{1}{2}$-in. webbing tape which is sewed at each end to prevent slipping.

Because the cables varied somewhat in resistance and reactance phase balance was achieved by stacking transformer iron around individual leads as necessary. Flat copper busbar for connections between the cable and the generator and transformer buses was borrowed from emergency stocks at other Edison hydro plants.

*(Jan. 23 issue, Electrical World)*

Oil-Immersed tape is used to splice high voltage cables because: Low power factor is maintained. Its dielectric strength in 12 mil thickness after elongation is 1,000 VPM. Tensile strength averages not less than 35 lb. per inch of width.

Because of its high dielectric and tensile strength, Irvington Seamless Bias Varnished Cambric Tape, Dry Packed, is used not only as the final wrapping on splices of high voltage lines but also for splicing low voltage cable.

Irvington

VARNISH & INSULATOR CO.

IRVINGTON, NEW JERSEY

PLANTS AT IRVINGTON, N. J. and HAMILTON, ONT., CAN.

Representatives in 20 Principal Cities

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TRADE REG. U. S. PAT. OFF. MARK

# *How* IRVINGTON-TAPED CABLE SPLICES HELPED GET POWER 3 MONTHS EARLIER!

The news story at the right speaks for itself. It reports how cable splicing sped power distribution to an area where shipbuilding and aircraft industries must be kept going full blast.

The story proves that when splices are wrapped with Irvington Varnished Cambric Tape, short cable lengths can be joined to serve in place of "not available" new cable. Irvington materials designed to aid in splicing are:

**Dry Packed Tape for Splicing Low Voltage Cable.** Cut from Seamless Bias Varnished Cambric, this tape is supplied in tightly wound rolls which are completely waxed to seal against moisture and air. The sealing prevents deterioration and maintains the dielectric strength of the tape during storage. This tape meets A.S.T.M. specifications.

**Oil-Immersed Tape for Splicing High Voltage Cable.** This tape has a low power factor which is maintained after the splice is made. The reason for this is the special processing which the tape undergoes in manufacturing and packaging. Not only does this processing maintain low power factor but it also preserves the tape's high dielectric strength. Oil-Immersed tape meets A.S.T.M. requirements.

**Cardolite No. 708 Cold-Setting Compound.** Used as a filling material within the lead sleeve over splices, this material is easy to handle because it does not require heating. It sets within two hours.

**Harvel Oil Stop.** This product, a phenol-formaldehyde synthetic resin, is used to make stop joints and for oil-tight splices on rubber to paper and paper to paper insulated cables. It is applied as a viscous liquid and polymerizes at ordinary temperatures into a firm, enduring, infusible insulation.

*For further information on these splicing materials, write Dept. 46.*

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A wide "vee" is necessary when the cable ends are joined together because the heat is carried off so rapidly that the torch tip must be worked down into the joint. Otherwise the soldering is too slow. In this step the cable ends are brought within ¼ in. of each other and silfos applied from the bottom of the "vee" upward, taking extreme care to bond solder to the cable in the building-up process. Next the bottom half-sleeve is applied, using care to see that silfos flows between cable and sleeve along all edges. The top half-sleeve is then applied in a similar manner. Approximately ¾ lb. of silfos is required for each joint.

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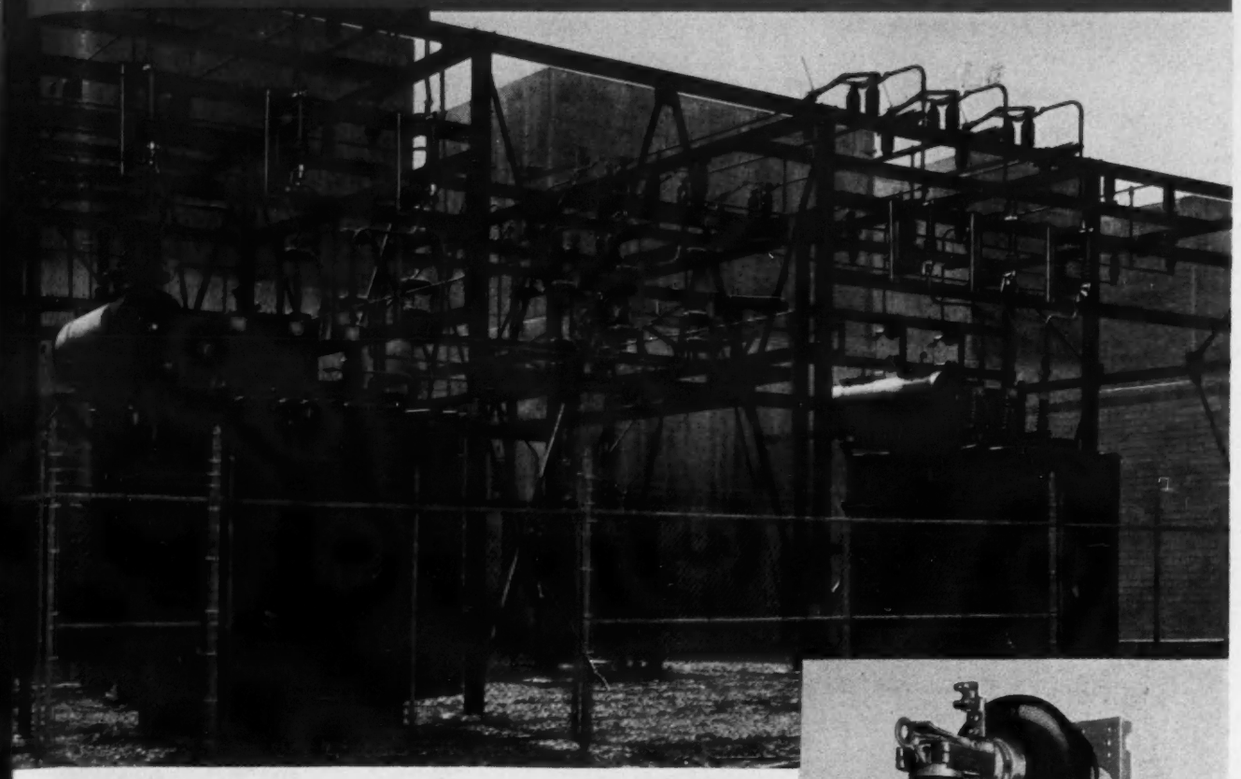
# PROTECTING VITAL PRODUCTION



POWER supply and electrical equipment for the great plants producing vital armament and other war materiel require dependable protection to insure against production delays.

Such protection is being provided by S & C Type "SM" Power Fuses for many important installations. The one shown above on the property of a large aviation engine plant illustrates the small space required. Electrical engineers have selected these fuses because of their dependability, uniform accuracy in time-current characteristics and their high interrupting capacity. Their use also saves labor and installation time,—and they require the use of very little critical metals compared to other types of interrupting equipment of equivalent capacity.

## High Interrupting Capacity

Within their ratings—S & C Type "SM" high interrupting capacity Fuses provide the ideal protection. They are made for indoor or outdoor service for 2300/4000, 6600, 13,200, 22,000, and 33,000 volt circuits in ampere capacities from 1 to 400, with short circuit interrupting ratings up to one millon KVA.

Recommendations by S & C engineers will help you select appropriate protective equipment.

**SHORT CIRCUIT-INTERRUPTING RATINGS IN R.M.S. AMPERES**

| Fuse Voltage Rating→ | 7,500 | 7,500 | 15,000 | 23,000 | 34,500 |
|---|---|---|---|---|---|
| Circuit Voltage→ | 2,300/4000 | 6,600 | 13,200 | 22,000 | 33,000 |
| **SMPC-4 | 17,500 | 15,000 | 12,500 | 10,000 | 7,500 |
| SMP-4 | 27,500 | 25,000 | 20,000 | 15,000 | 10,000 |
| †SMPC-5 | 30,000 | 25,000 | 20,000 | 17,500 | 15,000 |
| SMP-5 | 40,000 | 35,000 | 30,000 | 25,000 | 20,000 |

**Equipped with Condenser.

**SCHWEITZER & CONRAD, INC.**

**4435 Ravenswood Avenue, Chicago, Illinois**

*Manufactured in Canada by Powerlite Devices, Ltd., Toronto, Ontario.*

**TYPE "SM"**

**POWER FUSES**

# WESTINGHOUSE NEW DRY-TYPE TRANSFORMERS

36% copper saving . . . 50% steel saving . . . *and a better transformer!* That is the new Westinghouse Dry-type Distribution Transformer. (Ratings from 1 to 100 Kv-a.)

Three things make this transformer possible:

1. **HIPERSIL***: the new Westinghouse electrical steel that has one-third more flux-carrying capacity . . . saves copper and steel.
2. **CLASS B INSULATION**: permits more Kv-a output with less copper in the windings.
3. Westinghouse Engineering "KNOW-HOW" in pioneering and combining new developments into practical critical material-saving transformers.

The smallest and lightest indoor distribution transformer ever built, this new Westinghouse design adds to the inherent advantages of Dry-Type Transformers:

- **SPACE SAVING . . .** Mount a dry-type anywhere indoors . . . on a shelf, a post, or overhead.
- **TIMESAVING . . .** No fireproof vaults required.
- **IMPROVED VOLTAGE REGULATION and COPPER SAVING . . .** Located at the machine, the dry-type eliminates long heavy secondary runs.
- **NO LIQUIDS** to inspect, change or filter.

J-70399

**Ask your Westinghouse Representative for full details on this lighter and smaller transformer. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.**

*Registered trade-mark, Westinghouse Electric & Manufacturing Company, for HIgh PERmeability SILicon steel which carries ⅓ more flux.

Westinghouse DISTRIBUTION TRANSFORMERS

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

BUY U. S. WAR BONDS AND STAMPS

# Your local RCA TUBE and EQUIPMENT DISTRIBUTOR

DISTRIBUTOR
RUSH
RCA
√ TECHNICAL KNOWLEDGE of things Electronic.
√ TRADE KNOWLEDGE of what electronic materials are available, where they are available, and how they may be obtained as fast as circumstances permit.
√ NORMALLY LARGE STOCKS of RCA Tubes and countless other Radio and Electronic items—for prompt deliveries upon receipt of the necessary priorities.
√ AN EFFICIENT ORGANIZATION that is used to handling small orders—and equally well equipped to handle large ones, too.

# offers You THESE SERVICES

'Round the corner from your plant is a man whose chief stock in trade these days is his ability to help busy war industries get needed Radio and Electronic materials faster and use them to better advantage.

That man is your local RCA Tube and Equipment Distributor. Behind him is an organization which has been dealing with things Electronic since the "knee pants" days of Radio.

They know how to get the materials you need. They know how to use these properly once they've been obtained. You'll find their technical advice and recommendations as big a help as their personalized expediting service which assures fast, accurate deliveries.

Whether it's one RCA Tube or a hundred—they're ready and geared to help you. They'll help you, too, in obtaining condensers, resistors, rheostats, controls, potentiometers, coils, transformers, wire, and numerous other Radio and Electronic components produced by many manufacturers.

## RCA RADIO-ELECTRONIC TUBES

RCA Victor Division, **RADIO CORPORATION OF AMERICA,** Camden, N. J.

# DISTINCTIVE

as a *fingerprint*

Wherever terminals and connectors are being attached to small wires, Burndy HYLINE connections, applied with Burndy HYTOOLS, are setting new production records and slashing costs. HYTOOLS are specially designed for the application of HYLINE connections . . . and include simple hand tools for rapid, sound application, up to pneumatic and hydraulic presses for high production requirements. All tools indent the lug with the distinctive and uniform Burndy indent . . . your assurance of a secure, highly efficient electrical connection. For full facts on lowering connection costs the Burndy way, write connector headquarters today.

*Headquarters for connectors*

# BURNDY

BURNDY ENGINEERING CO., INC. • 107 EASTERN BOULEVARD, NEW YORK CITY

OLIVER

# OLIVER PINS

## *sizes and types for every application*

Oliver Insulator Pins are made in well over a hundred styles, sizes and types for screw, clamp or bolt fastening; for wood and steel crossarms, steel transposition brackets and break arms, for poles, pole tops, etc.

They are made from mild open-hearth steel, hot dip galvanized. Various types of Oliver Insulator Pins are fitted with different kinds of threads: steel, malleable iron, lead, zinc. Special Oliver construction assures a perfect bond between pin and thread. Cobs are made from seasoned wood, thoroughly impregnated with paraffin. Write for complete information.

OLIVER
IRON AND STEEL
*Corporation*
*Makers of Pole Line Materials Since 1894*
PITTSBURGH, PENNSYLVANIA

No. 3300 No. 3496 No. 3735 No. 3418 No. 3402

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# PERMANENT

**PROTECTION TO CABLE ENDS IS THE PRIMARY PURPOSE OF G&W POTHEADS**

**G&W RESISTOYL GASKETS**
**AND PROPERLY DESIGNED JOINTS HAVE SOLVED THE PROBLEM OF MAINTAINING TIGHT POTHEADS**

G&W ELECTRIC CABLE DEVICES

**G & W ELECTRIC SPECIALTY CO.**
**7780 DANTE AVENUE • CHICAGO, ILLINOIS**
*In Canada—Powerlite Devices, Ltd., Toronto, Ont.*

POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNECTS

# *"Tomorrow may be too late—do it today!"*...CHECK UP!

THIS

**ELECTRICAL FAILURE HALTS WAR PRODUCTION**

MIGHT HAVE PREVENTED

THIS

WARTIME restrictions make copper products hard to get — this includes electrical wire and cable. It will pay you to protect what you have.

Anaconda's Preventive Maintenance Plan will help you check to see that cables in your plant are not being abused.

If you follow this free plan you not only help yourself, but more important, you help the war effort. This manual provides a practical automatic method for complete analysis of circuits and equipment... uncovers potential weaknesses ... methods for correcting them... with charts to enable quick periodic check-ups.

**NOTE:** Through this Preventive Maintenance Plan you may uncover the evidence necessary to obtain an "emergency repair priority." This is explained fully in the plan book.

48227

## ANACONDA'S PREVENTIVE MAINTENANCE PLAN

Anaconda Wire & Cable Company
25 Broadway, New York City

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding production.

Individual .....

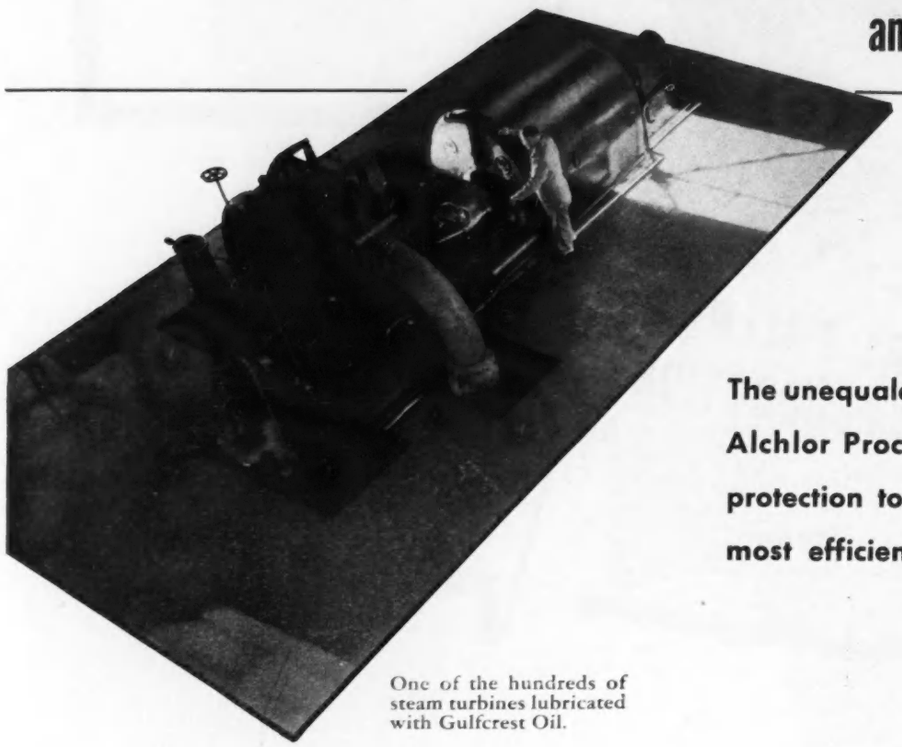
Company .....

Address ..... City .....

4L

# GULFCREST OIL

## stands alone in its high resistance to oxidation, acidity, and sludge



One of the hundreds of steam turbines lubricated with Gulfcrest Oil.

**The unequaled refining power of the Alchlor Process insures maximum protection to turbine bearings and most efficient turbine performance**

THE stability and endurance of a turbine oil—and the degree of protection it provides—are directly related to the amount of impurities which remain in it after refining. That is why the development of Gulf's Alchlor *Super-Refining* Process has proved such an outstanding contribution to turbine lubrication.

For the Alchlor Process is the most effective oil purifying method known—it not only removes the general run of impurities present in all crude oils, but eliminates oxidation catalysts and synthesizes and rearranges the molecular structure of certain active hydrocarbons. This unequaled refining power of the Alchlor Process produces a turbine oil with highest resistance to oxidation, acidity and sludge—an oil that insures maximum protection to precision turbine bearings and most efficient turbine performance. Gulfcrest Oil is the world's finest oil for turbine lubrication!

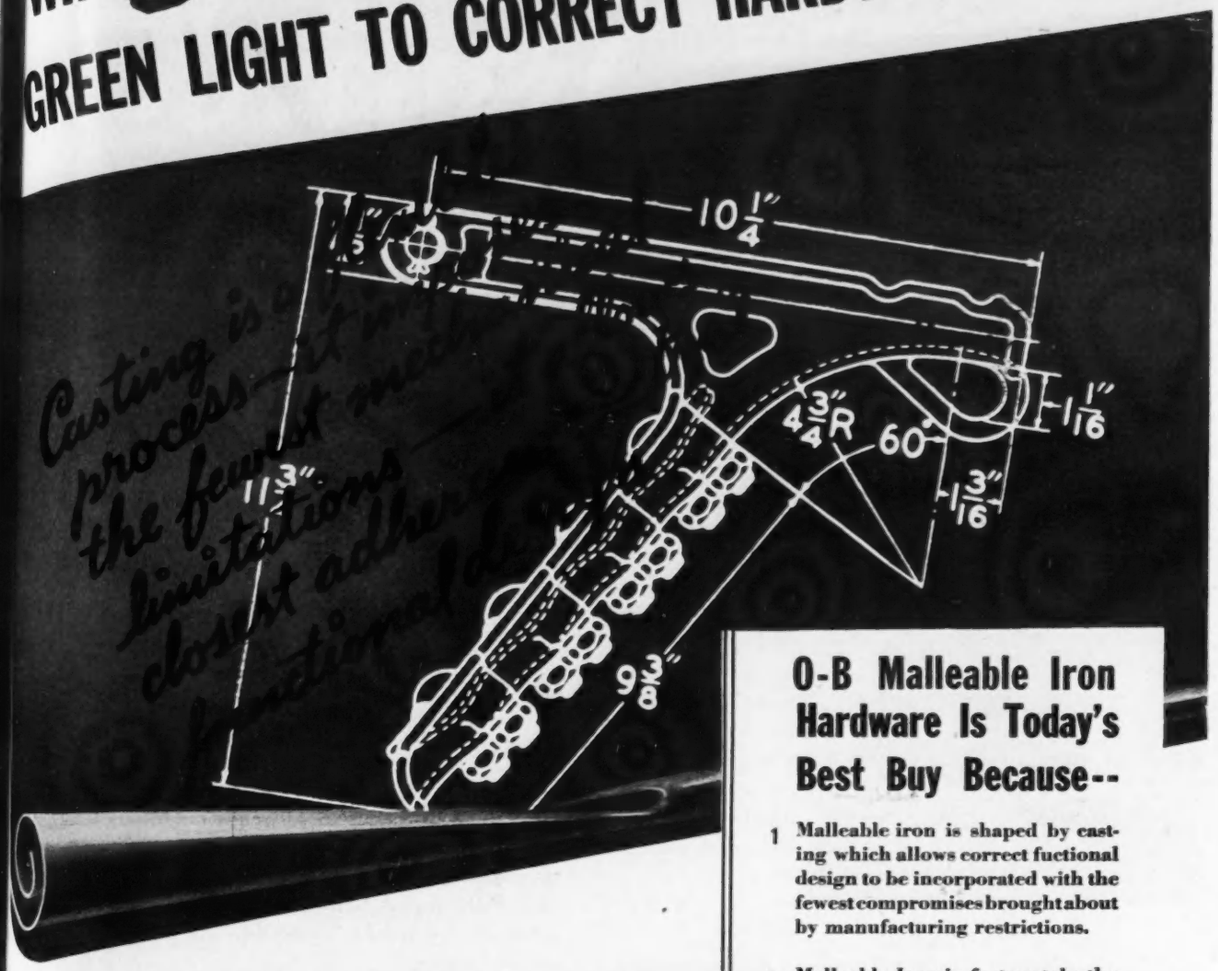
Talk with a Gulf Lubrication Service Engineer about this remarkable turbine oil at your earliest opportunity. He will be pleased to give you complete details, without obligation.

GULF INDUSTRIAL LUBRICATION

For Victory Buy United States War Bonds and Stamps

*GULF OIL CORPORATION · GULF REFINING COMPANY · PITTSBURGH, PA.*

# WHY *Casting* GIVES THE GREEN LIGHT TO CORRECT HARDWARE DESIGN




For the particular job of making line hardware, casting imposes the fewest design restrictions. Functional or theoretical shapes, proved or amended by long field experience, are not sacrificed because of factory production problems. That is why O-B casts its hardware. It is cast in malleable iron for the reasons briefly listed to the right... You needn't look far to find an O-B hardware user. Ask him about any phase of O-B design; ease of installation, strength, durability. You'll see there are some *real* reasons why O-B hardware should be your choice.

2422-H

## O-B Malleable Iron Hardware Is Today's Best Buy Because--

1. Malleable iron is shaped by casting which allows correct fuctional design to be incorporated with the fewest compromises brought about by manufacturing restrictions.
2. Malleable Iron is, fortunately, the least critical metal in the ferrous group--easiest to obtain for approved use.
3. Malleable iron has a good, practical ratio of strength to weight--O-B hardware is amply strong for the heaviest service.
4. Malleable iron, upon rusting, forms a tenacious, indestructible coating of iron-oxide that acts as a perfect protection for the metal underneath--it is unique in this valuable respect.
5. Malleable iron is extremely ductile--will withstand severe twisting and bending without failure.

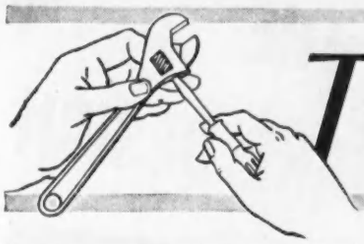
*Ohio Brass*

MANSFIELD, OHIO

*Canadian Ohio Brass Company, Ltd., Niagara Falls, Ont.*

★

KEEP BUYING
UNITED STATES WAR BONDS



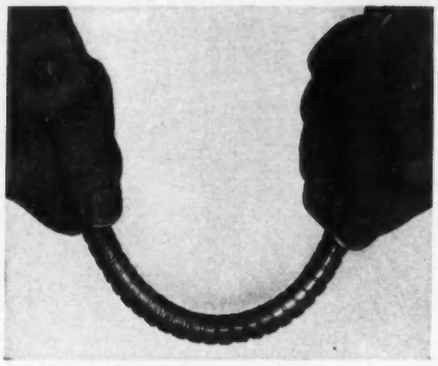
# TOOL NOTES

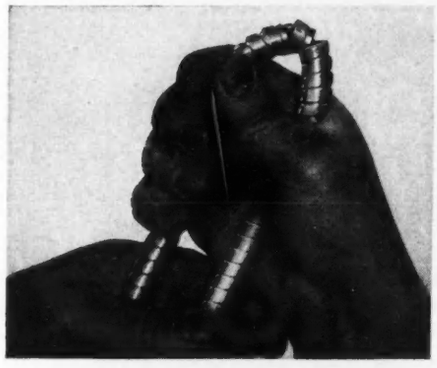
"How To Do It" Information For Crescent Tool Users

## No. 9 HOW TO CUT BX ARMORED CABLE

Here are two methods of cutting BX Armored Cable. Both assure a workmanlike result, and save time.

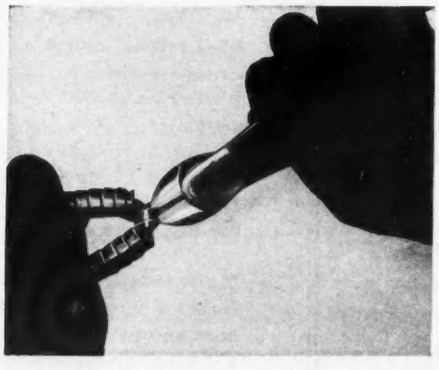
**1.** Grasp the cable with your hands as shown, either side of the point to be cut. Bend sharply until a spiral breaks open. Then reverse this procedure by . . .

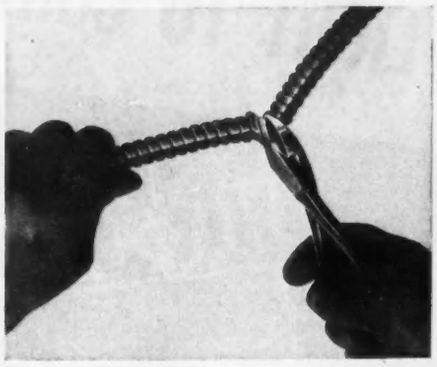




**2.** . . . bending the cable sharply in the opposite direction. This operation will separate a single spiral of cable. Grasp the cable close to the break and . . .

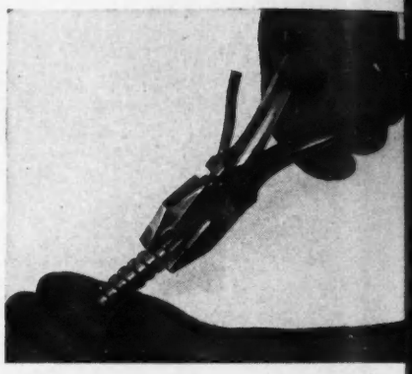
**3.** . . . cut the exposed and separated spiral with a pair of Crescent No. 542 Heavy Diagonal Pliers, using care not to cut the insulated wire beneath.





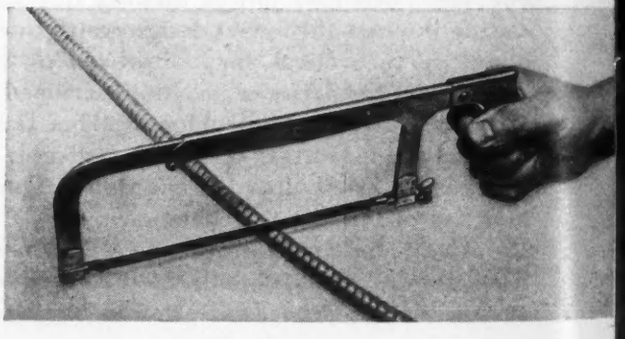
**4.** Now cut thr the paper in sulation an wires with you Crescent Heav Diagonal Cutter as shown. Thei powerful lever age will readil sever even heav insulated wire

**5.** Last, squeeze back sharp end of the armor with a pair of Crescent's No. 1950 Linemen's Pliers and you have completed a neat, workmanlike job.



### THE HACKSAW METHOD

Instead of using a pair of heavy diagonals for the first three steps, a Crescent Hacksaw may be used. Clamp the cable in a vise, and saw across one spiral at the angle illustrated below, using care not to cut the insulated wire inside. Complete the job as explained in steps 4 and 5.



**CRESCENT TOOLS**
*Give Wings to Work*

**REPRINTS OF THIS SERIES**

. . . including the previous 8 informative advertisements are available without charge. State whether you want them for bulletin board use or to fit a standard 3-ring binder.

*Write direct to:*

**CRESCENT TOOL COMPANY**
JAMESTOWN, N. Y.

# WHEN THE BLACKOUTS ARE OVER.. *Forever!*

WHEN at last there is peace again and America can resume its progress toward ever higher living standards, electricity will take on a greater significance than ever before.

Take the time now to think about your electric meter requirements when that day comes. You will need modern, trouble-free meters that will be accurate over a wide range of load conditions. Duncan Meters offer you these features and a host of advantages including Porcelain Bases, Alnico Magnets, Lifetime Bearings, Microset Adjustments and Layer-on-Layer Construction.

**DUNCAN METERS FOR ESSENTIAL SERVICE**

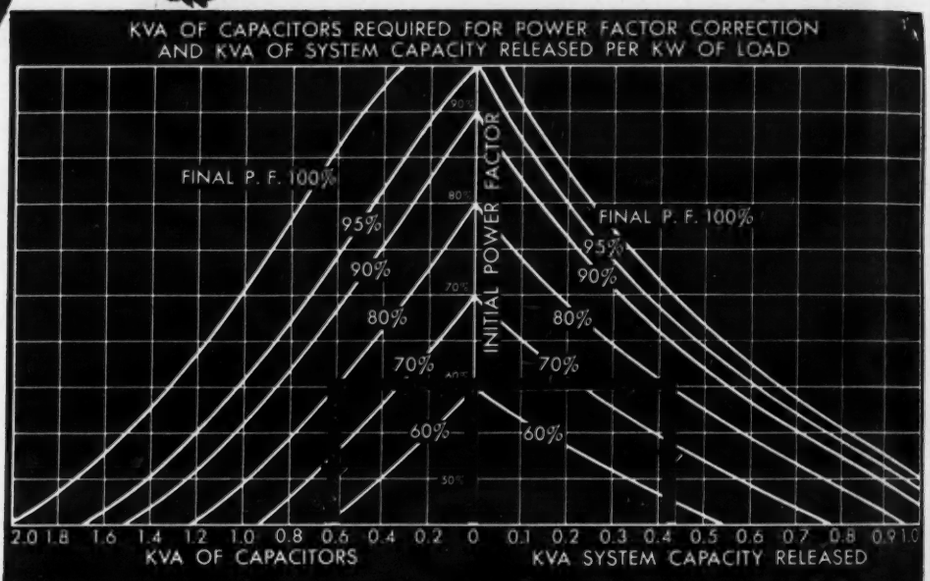
*Where meters are necessary for essential service, you can still have "the finest meters Duncan ever built"—meters produced by skilled workers and precision machines that are now humming 24 hours a day on War Work. Deliveries are of course subject to priority regulations.*

# DUNCAN

ELECTRIC MFG. COMPANY

Lafayette • Indiana

# Reduce




**NOTE FROM THIS CHART HOW INERTEEN CAPACITORS** release power capacity. Blue line indicates how capacitors solved the production problems of a midwest factory.

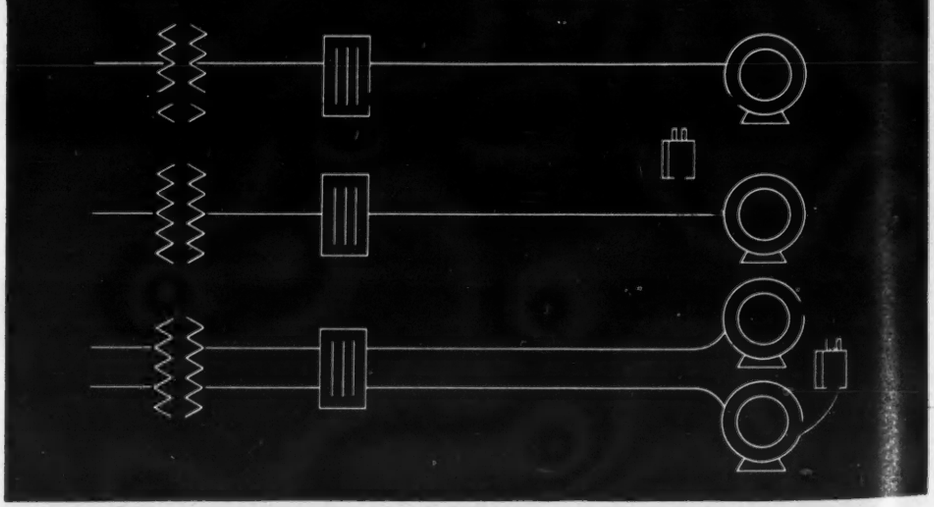
**THE PROBLEM:** To get more production from existing facilities.

**THE SOLUTION:** Installed capacitors, raising power factor from 60% to 80%.

.6 Kv-a of capacitors were required per Kw of load **(A)**.

**THE RESULT:** .42 Kv-a of capacity was released per Kw of load **(B)**.

No new lines were needed to provide this "power for victory."



Induction motors draw two kinds of current.

•

Capacitors neutralize "out-of-phase" amperes relieving wiring, transformer, switching equipment and generators.

•

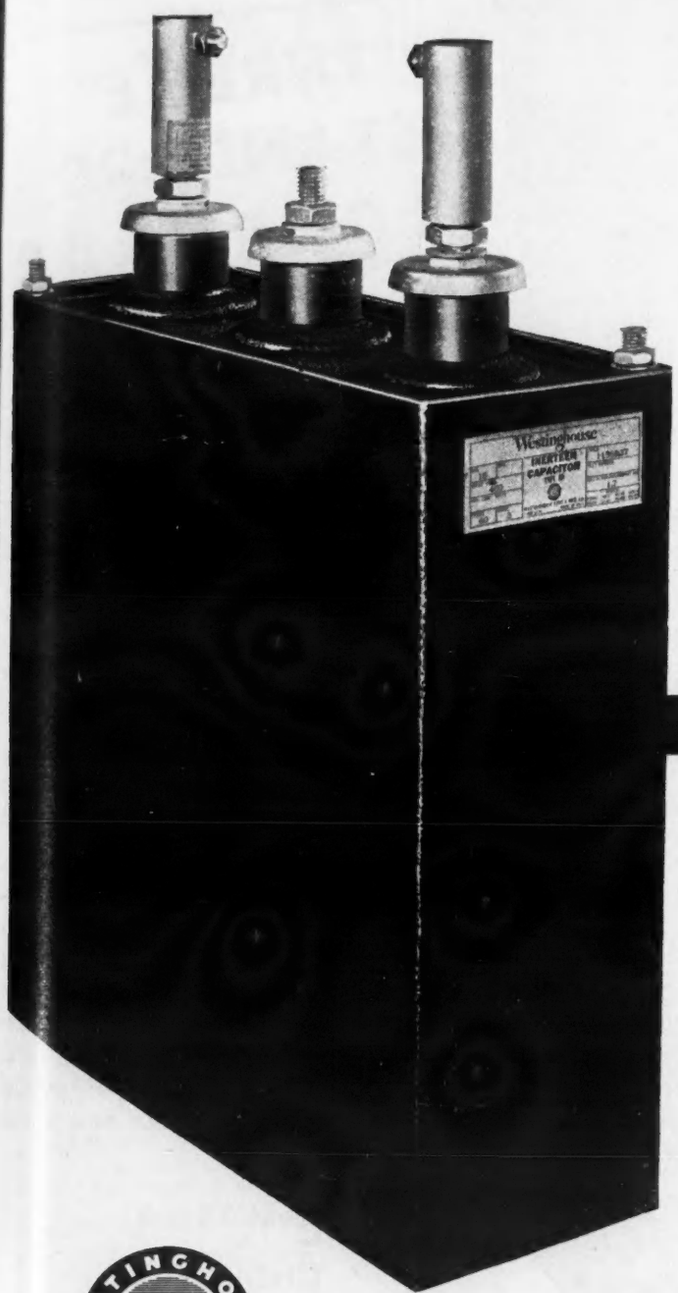
Result: More capacity for war production!

# Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

# power losses

## ADD KV-A FOR VICTORY




Westinghouse capacitors provide the perfect answer to today's need for "Making the Most of What We've Got."

By installing capacitors on existing power lines, we can:

1. Secure additional productive capacity from existing lines.
2. Save critical materials required for the construction of new lines.

One-third to ⅔ Kv-a of load-carrying capacity is released by every capacitor Kv-a installed . . . lighting and motor performance is improved . . . dangers incident to overloaded systems are eliminated.

J-90471

For facts about capacitors and information on other methods of saving critical materials, send for this book. It tells how to:

**SAVE CRITICAL MATERIALS** in selection, application and use of electrical equipment.

**USE NEW METHODS** developed by Westinghouse to speed war production.

**KEEP EQUIPMENT RUNNING** through proper maintenance and repair service.

**REPLACE CRITICAL MATERIALS** with Micarta and Prestite.

**SAVE SCRAP** by systematic salvage.

WESTINGHOUSE

**WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, EAST PITTSBURGH, PA., DEPT. 7-N**

# ONE STANDARD UNIT - - - -

**MOUNTED IN ANY POSITION**

**vertically or horizontally**

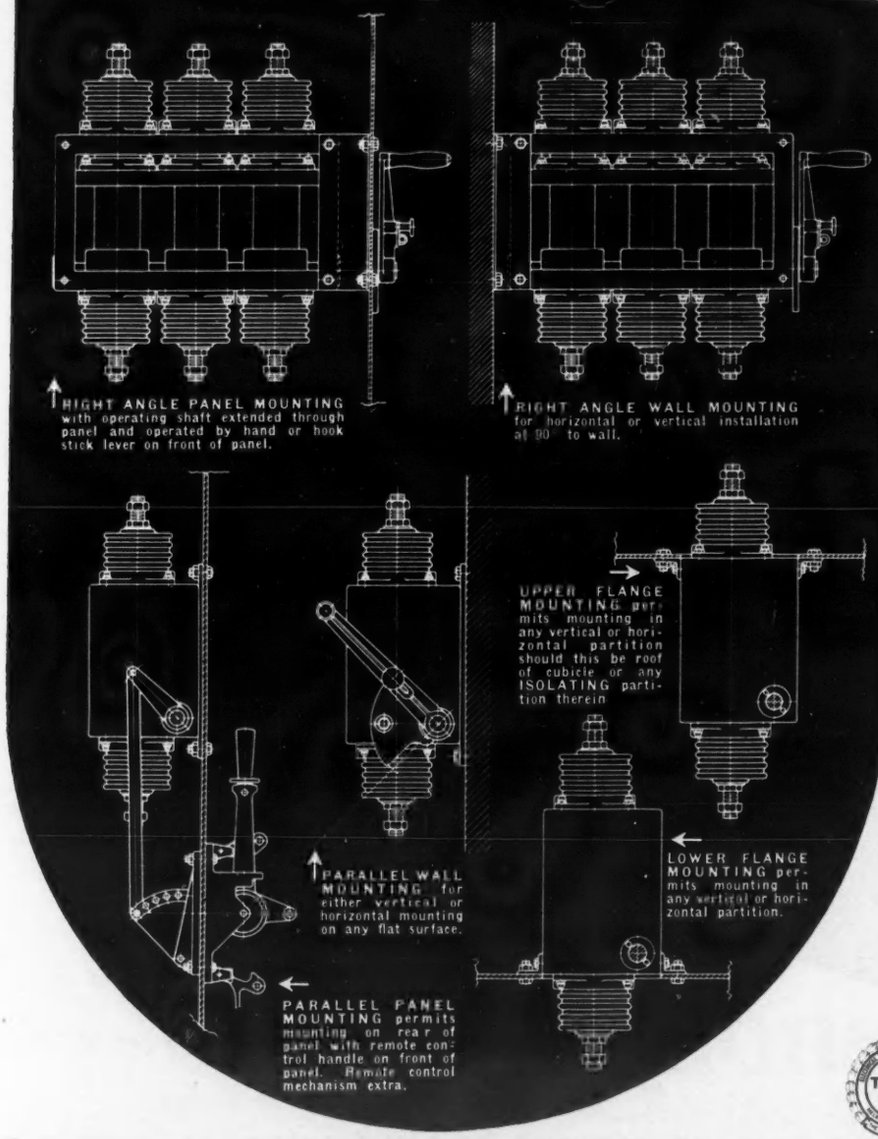
## "THREE E" STANDARD ISOLATORS

now easily fit into various mounting conditions and make possible quick compact installations.

The new STANDARD ISOLATOR with one piece welded steel frame fits all mounting requirements by merely changing the mounting brackets. This also permits conversion from one mounting to another in the field.

Drawings at the left indicate the numerous mounting positions in which the STANDARD ISOLATOR can be used.

Another important point to consider regarding the STANDARD ISOLATOR is the fact that changes in mounting can easily be made at the factory, even after your order has been placed, or in the field. We simply supply the proper mounting to meet your new specifications.

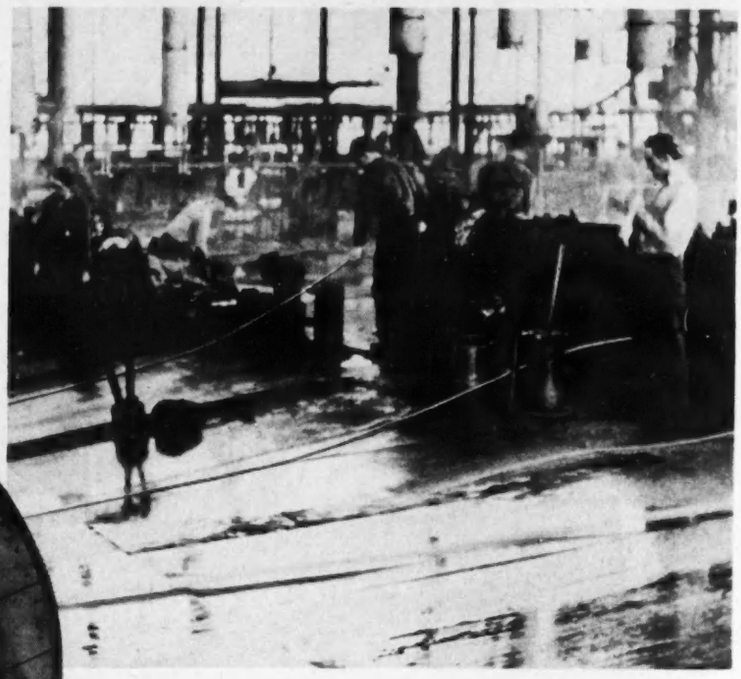

RIGHT ANGLE PANEL MOUNTING with operating shaft extended through panel and operated by hand or hook stick lever on front of panel.
RIGHT ANGLE WALL MOUNTING for horizontal or vertical installation at 90° to wall.
UPPER FLANGE MOUNTING permits mounting in any vertical or horizontal partition should this be roof of cubicle or any ISOLATING partition therein
PARALLEL WALL MOUNTING for either vertical or horizontal mounting on any flat surface.
LOWER FLANGE MOUNTING permits mounting in any vertical or horizontal partition.
PARALLEL PANEL MOUNTING permits mounting on rear of panel with remote control handle on front of panel. Remote control mechanism extra.

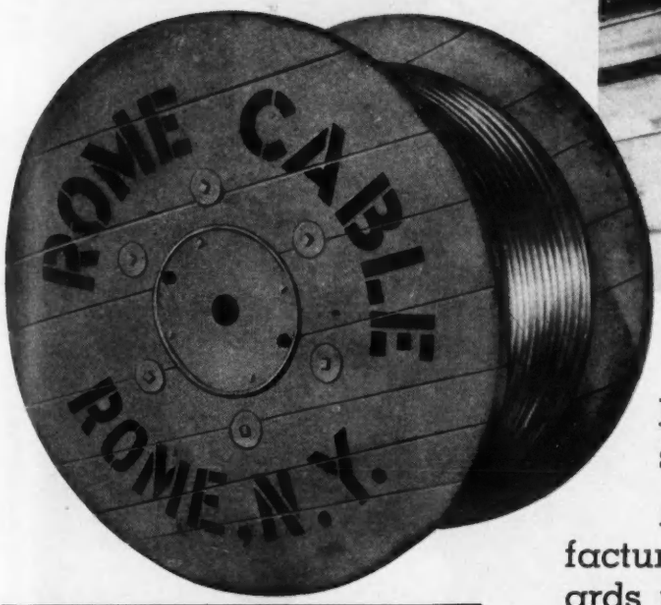
ELECTRICAL ENGINEERS EQUIPMENT CO. Melrose Park Illinois

# *Every Stage in Wire-Making*

## *is Controlled by*

# ROME CABLE






Maintaining our own rolling mills, we start fabrication with the copper bar.

All Rome Cable products are manufactured in our own mills to exacting standards under strict engineering supervision. Every process is carefully controlled and no finished products are released without the approval of our Inspection Department.

**REASONS FOR ROME CABLE QUALITY**

### *PRODUCTS*

**HOT ROLLED COPPER RODS**

**BARE AND TINNED COPPER WIRE**
**(in rounds, flats and squares)**

**BARE AND TINNED STRAND**

**URC WEATHERPROOF WIRE**

**COTTON, PAPER AND ASBESTOS MAGNET WIRE**
**(in rounds, flats and squares)**

**RUBBER INSULATED WIRES AND CORDS**

**SYNTHETIC INSULATED WIRES AND CABLES**
**(Thermoplastic—Neoprene)**

**LEAD COVERED CABLES**

**SERVICE ENTRANCE CABLES**

★ ★ ★

***"Rome 60" Heavy Duty Cords and Cables***

# ROME
# CABLE CORPORATION
## ROME, N. Y.

***SALES OFFICES***

**NEW YORK**
**60 E. 42nd. St.**

**CHICAGO**
**208 S. Jefferson St.**

**LOS ANGELES**
**327 E. 4th. St.**

**PITTSBURGH**
**2537 Koppers Bldg.**

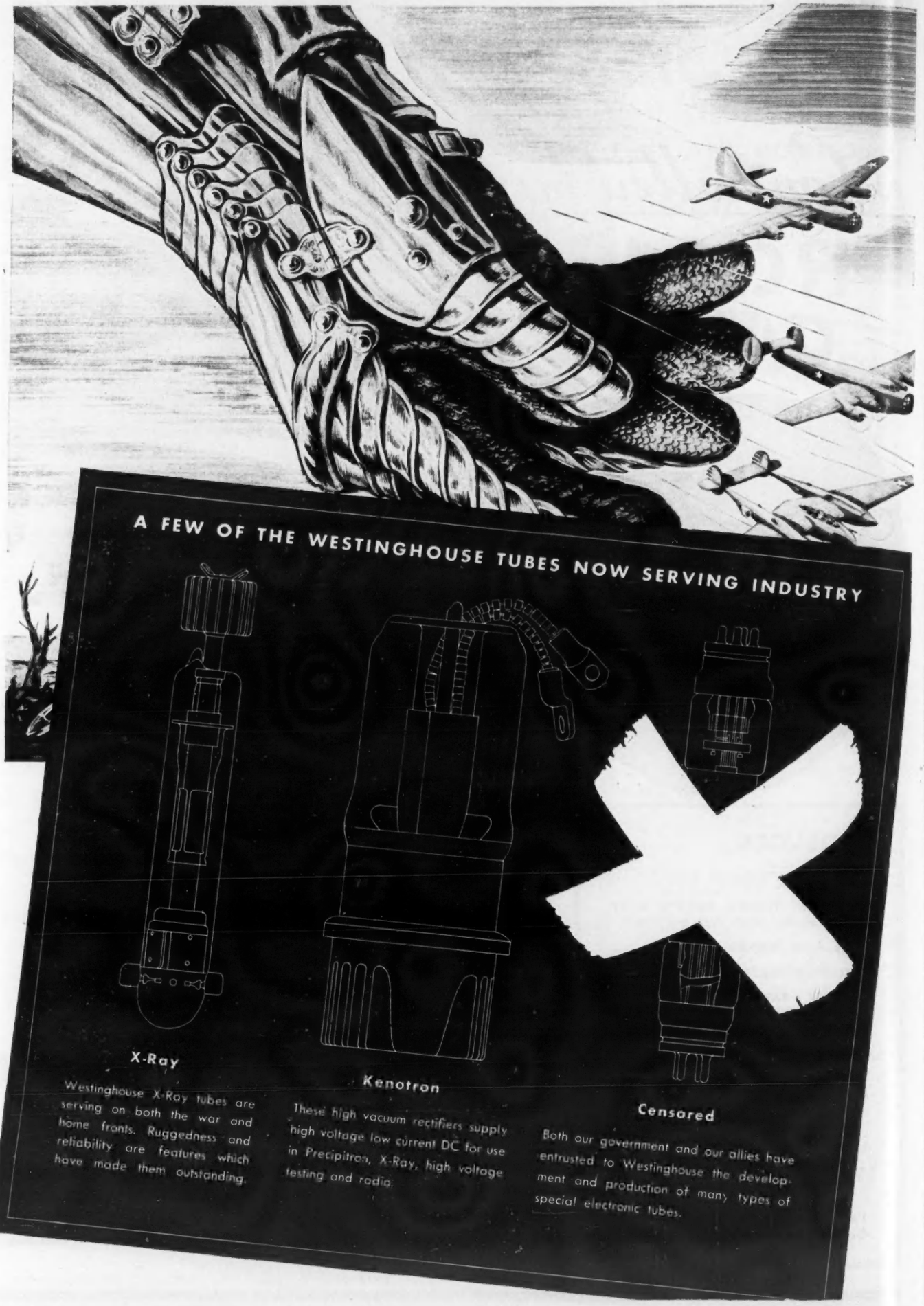
**CLEVELAND**
**817 Citizens Bldg.**

**PHILADELPHIA**
**1803 Liberty Trust Bldg.**

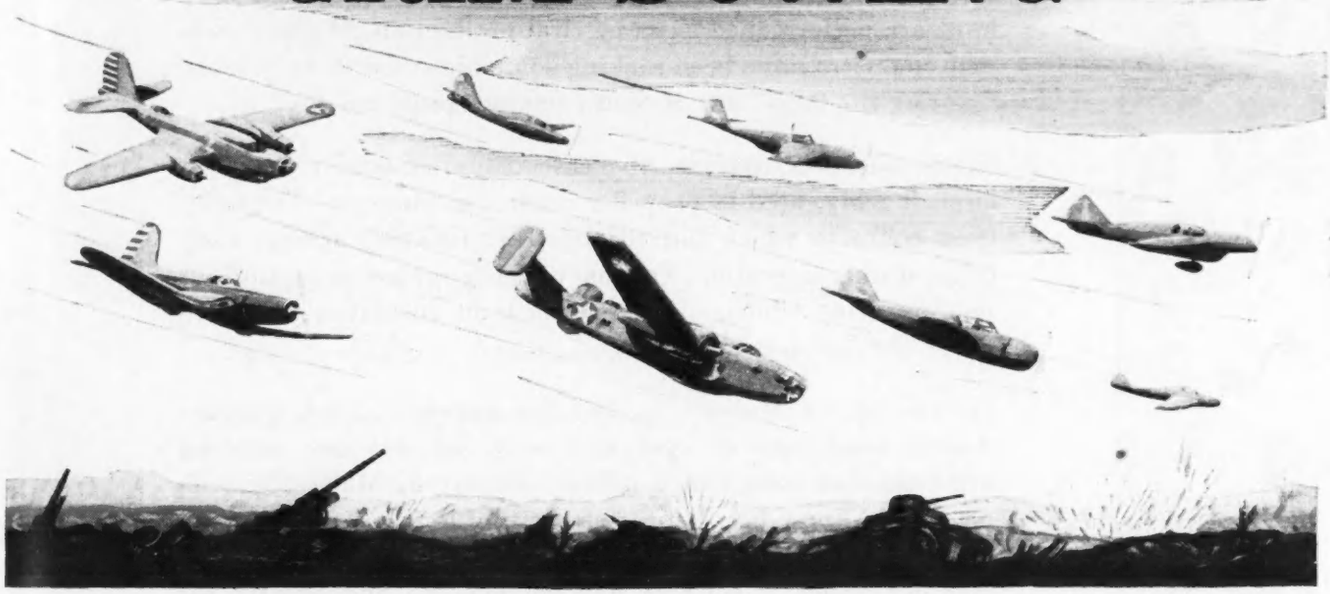
**MARSHFIELD HILLS, MASS.**

**RICHMOND, VA.**
**2027 South Blvd.**

**WASHINGTON, D. C.**
**Room 410, Bond Bldg.**


A FEW OF THE WESTINGHOUSE TUBES NOW SERVING INDUSTRY
X-Ray
Westinghouse X-Ray tubes are serving on both the war and home fronts. Ruggedness and reliability are features which have made them outstanding.
Kenotron
These high vacuum rectifiers supply high voltage low current DC for use in Precipitron, X-Ray, high voltage testing and radio.
Censored
Both our government and our allies have entrusted to Westinghouse the development and production of many types of special electronic tubes.

# A GOOD HARVEST *from a* GRIM SOWING



There are no bright sides to war. But from the efforts expended to win the war, is coming a harvest of great things.

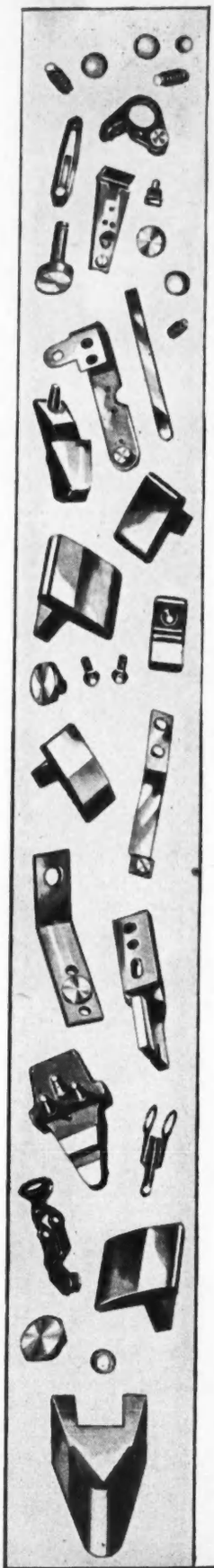
In Electronics, for example—new weapons of attack, new weapons of defense, new means for aiding production, are already at work. Westinghouse is supplying electronic tubes for many of these operations, tubes that put the principles of electronics to work today. These tubes are winning high honors for accuracy, design, dependability.

Tomorrow, the "know-how" gained from today's war efforts, will be at work in the service of industry.

In your thinking and planning for today and tomorrow, include the use of electronic tubes. Westinghouse — pioneers in electronics — will be at your service. Westinghouse Electric and Manufacturing Co., Bloomfield, N. J.

Westinghouse

Electronic Tubes *AT WORK*



# Not All Bug Hunters Are Biologists

A good many of them are engineers—and the bugs they hunt are performance flaws in vital production. Mallory contact engineers have been making some nice records in quickly "getting the bugs" out of tricky contact problems.

There was, for example, the case of an unusually designed aircraft relay, used in propeller control mechanism. The relay used contacts which butted together, rotating against each other during operation. Ordinary facing materials ground off fine particles which shortly formed an insulating layer to make the contacts inoperative.

It was up to Mallory to find an answer . . . and quickly. Actual conditions of operation were set up; one material after another tested, new alloys originated. Mallory experience and "know how" speeded the solution to a prompt conclusion with a complete contact assembly. A new material was developed, a suitable backing evolved and shortly the contact relays functioned perfectly. Another cog in War Production mechanism was in good working order. It sounds very simple and matter of fact.

But what made the result seem so simple was the applied technique of many years of research and experiment. Mallory engineers have pioneered so long in the contact field that their knowledge brings prompt results as a matter of course.

*While the design is still in blueprint form*

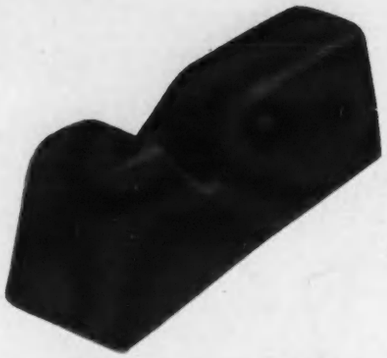
**CONSULT MALLORY**
*for Contacts and Contact Assemblies*

Nowadays, when a contact or complete contact assembly problem arises, it is only natural to call in Mallory. Their services are at your disposal.

**P. R. MALLORY & CO., Inc.**
**INDIANAPOLIS INDIANA**
*Cable Address—PELMALLO*

P.R. MALLORY & CO. Inc.
MALLORY

**ELECTRICAL CONTACTS AND CONTACT ASSEMBLIES . . . NON FERROUS ALLOYS POWDERED METAL ALLOYS**



# We are in the Copper Saving Business

. . . Yes, saving copper is our business. Millions of pounds of copper were saved during our first war year and millions more will be saved this year with Copperweld. Copperweld is saving 60 to 70 per cent of its weight in copper for every foot of it used as power conductors, communication conductors, and in special applications for our Armed Forces.

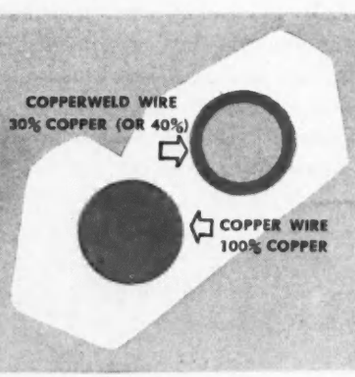
A plus value to the saving in copper are all the important advantages that go with the use of Copperweld:— strength — rust-resistance — light weight — ease of handling and installation. Our country's available copper supply can be stretched by using Copperweld.

To save copper for Victory, check every job to see if Copperweld won't meet your requirements.

**COPPERWELD STEEL COMPANY** · *GLASSPORT, PA.*

**COPPERWELD**

SAVE HUNDREDS OF TONS OF COPPER



## PLAN YOUR DISTRIBUTION SYSTEM

# FOR *Quick Conversion*

Future demands on your plant depend on events no man can accurately foretell. Sound practice today calls for farsighted planning—to insure the ability to make quick production shifts economically.

Such shifts depend to a large extent on your plant distribution system. For on it hinges the ability to meet quickly changes in the nature, location and density of loads.

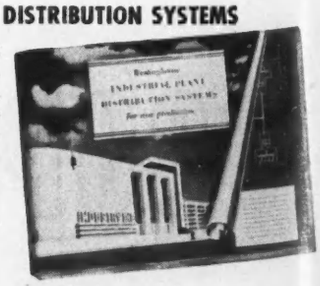
That's why we say *plan now for maximum flexibility in your plant distribution system*—to give increased efficiency and sabotage protection today, to facilitate speedy and economical conversion tomorrow.

Westinghouse has designed and built hundreds of distribution systems for all types of plants. Thus our engineers are in a position to recommend the "one best" distribution system for your plant—the system that provides maximum flexibility with the least use of critical materials.

To bring this broad engineering experience to bear on your particular problem, call our local office. Or send for the helpful booklet below. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pennsylvania. J-94562

### UP-TO-DATE FACTS ABOUT DISTRIBUTION SYSTEMS

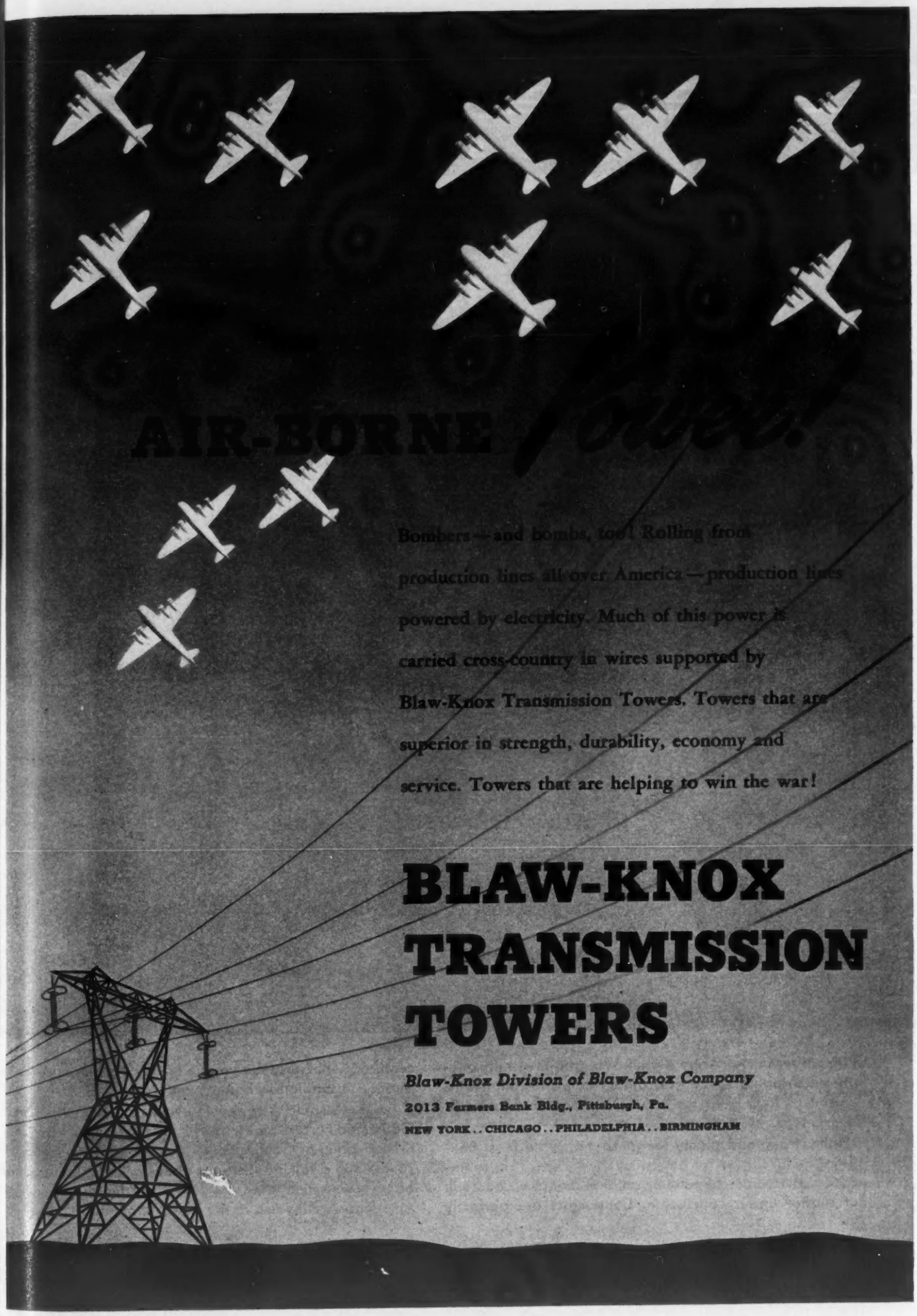
Keep up-to-date on latest plant distribution systems. Send for 24-page Booklet, B-3152, which briefly describes different plant distribution systems, and points out the advantages of each.



**Westinghouse**

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

PLANT DISTRIBUTION SYSTEMS


AIR-BORNE power!
Bombers—and bombs, too! Rolling from production lines all over America—production lines powered by electricity. Much of this power is carried cross-country in wires supported by Blaw-Knox Transmission Towers. Towers that are superior in strength, durability, economy and service. Towers that are helping to win the war!
BLAW-KNOX TRANSMISSION TOWERS
Blaw-Knox Division of Blaw-Knox Company
2013 Farmers Bank Bldg., Pittsburgh, Pa.
NEW YORK . . CHICAGO . . PHILADELPHIA . . BIRMINGHAM

FIVE SHIPS FOR ORDINAR

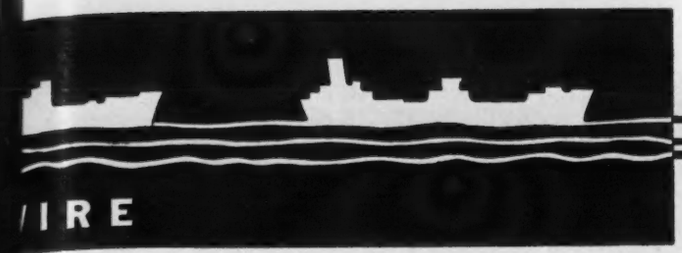
U. S. Rubber Laytex Army Assault Wire requires only one-fifth the shipping space of ordinary communication wire ... releases four times the room for men, material, food for overseas.

Light, strong and plenty tough, Laytex is the most flexible of all insulation for electrical conductors. It is waterproof, resists wide-range temperature changes...and will not shatter under concussion. Conductors are perfectly centered...because the unique Laytex Process applies the purified insulation in liquid form.

Laytex Assault Wire meets every basic requirement of the Armed Forces. It weighs less than 30 pounds per mile, twisted pair; has a breaking strength of 50 pounds per conductor; a talking distance of five miles. Millions of feet of Laytex Assault Wire are now on active duty wherever American Armies are in the field.

1230 Sixth Ave

# UNITED STATES R



ONE SHIP FOR
U. S. LAYTEX ASSAULT WIRE

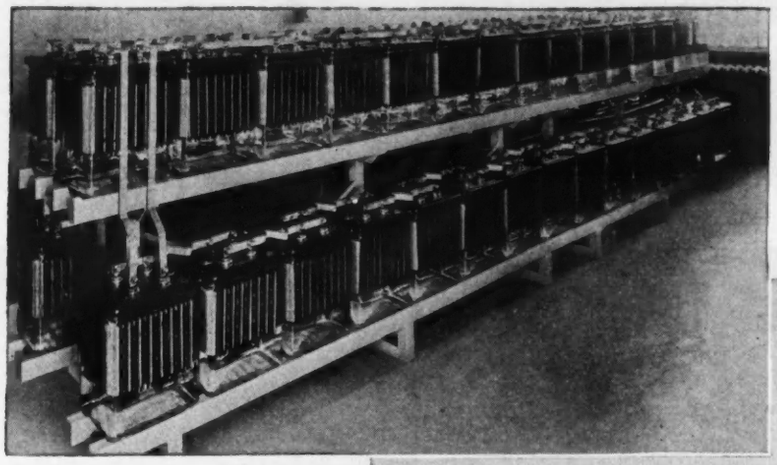
# N(SPACE REQUIRED FOR
# ASSAULT WIRE

Laytex
REG. U. S. PAT. OFF

## ASSAULT WIRE MEETS EVERY BASIC MILITARY REQUIREMENT

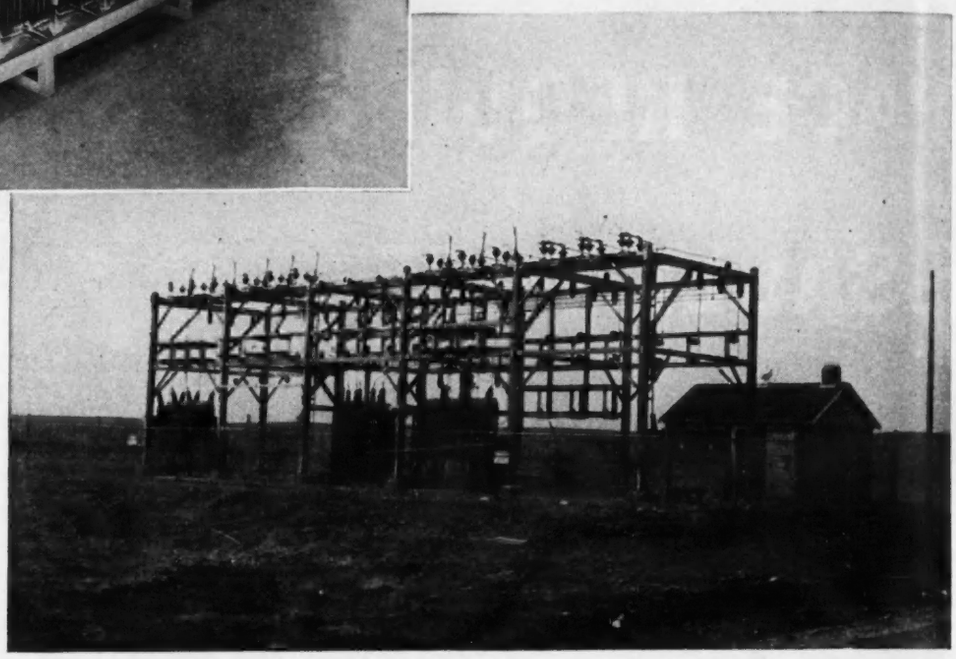
kefeller Center • New York

# RUBBER COMPANY



Left: A typical 60-cell Exide-Chloride Battery for control-bus service, similar to the one mentioned below.

Below: Bowdle Substation of the Dakota Public Service Company, through which power from the Northwestern Public Service Company is interchanged.



**Exide**
**CHLORIDE**
**BATTERIES**



# SMALL SUBSTATION OR MAIN POWER PLANT

## *the Exide-Chloride's dependability assures their protection*

***TO MAKE YOUR BATTERY LAST—***

1. Add approved water at regular intervals. Probably your local water supply is safe to use. If in doubt, ask us.
2. Keep top of battery clean and dry.
3. Check your D.C. control-bus voltmeter to see that it is in calibration. Keep battery fully charged but not overcharged.
4. Keep written records of water additions, voltage, and gravity.

IT isn't large, that substation of the Dakota Public Service Company, located at Bowdle, S. D.—but it *is* important. For the three 38 KV and one 33 KV lines of the Dakota Public Service Company and the Northwestern Public Service Company—two separate organizations—are tied in at this substation, permitting the interchange of 1.5 million KVA per month.

Circuit breakers at this well equipped substation are provided for automatic switching through a 2000 KVA, 38/33 KV stepdown transformer.

Like so many of the nation's largest power plants and generating stations, the Bowdle substation relies upon Exide-Chloride Batteries for the operation of its oil circuit breakers. Here a 60-cell Exide-Chloride, provides ample power for this important task.

The Exide-Chloride Battery's long life and dependability are almost traditional. And while it requires the minimum of maintenance care, every effort should be made to see that this care is administered faithfully during these trying times. If you need any help in solving your battery problems, our Engineering Service Division will be glad to assist you. Write for Bulletin 3225.

THE ELECTRIC STORAGE BATTERY COMPANY
PHILADELPHIA
Exide Batteries of Canada, Limited, Toronto

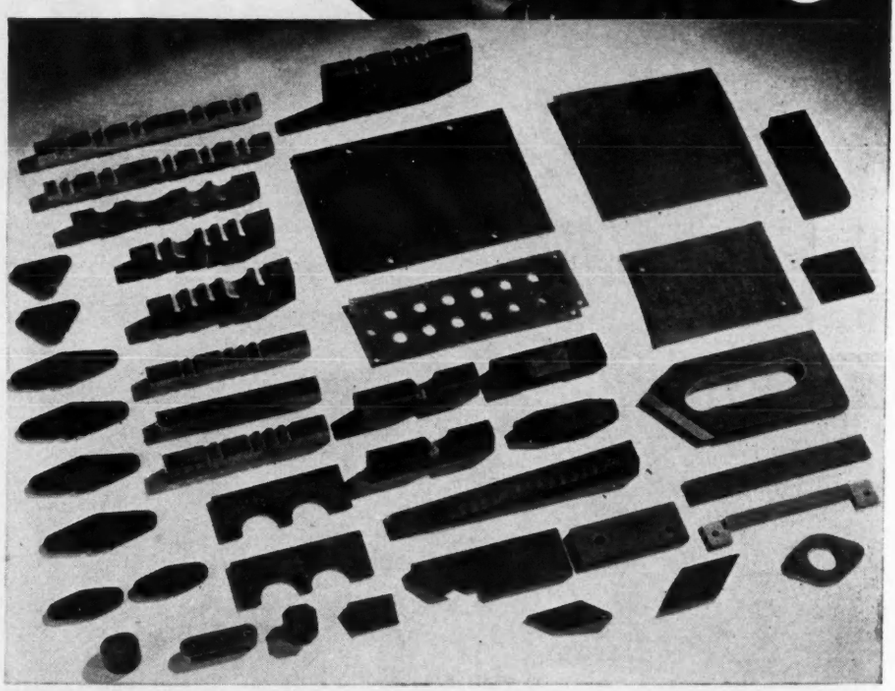
RADIO OPERATOR PHOTOS COURTESY PAN AMERICAN AIRWAYS

# LENGTHENING SHADOWS OF PROGRESS

Today, radio communications in civil and military aviation is an important and necessary adjunct that makes possible successful flight operations. Yet, it is only a short time ago since radio played a secondary role in aviation, because of its being subject to the vicissitudes of weather, altitude and distance.

Radio's importance and dependability might well be considered the ever-lengthening shadow of scientific progress . . . the result of improvement, research and the use of better functioning materials.

C-D rightfully claims a large part in radio's importance to modern flying, because of the steady progress on C-D's part in producing plastics such as Dilecto, Celoron and Dilectene . . . plastics from which hundreds of insulating parts, as pictured, are made . . . These C-D Plastics have been engineered to meet "flying" radio conditions.



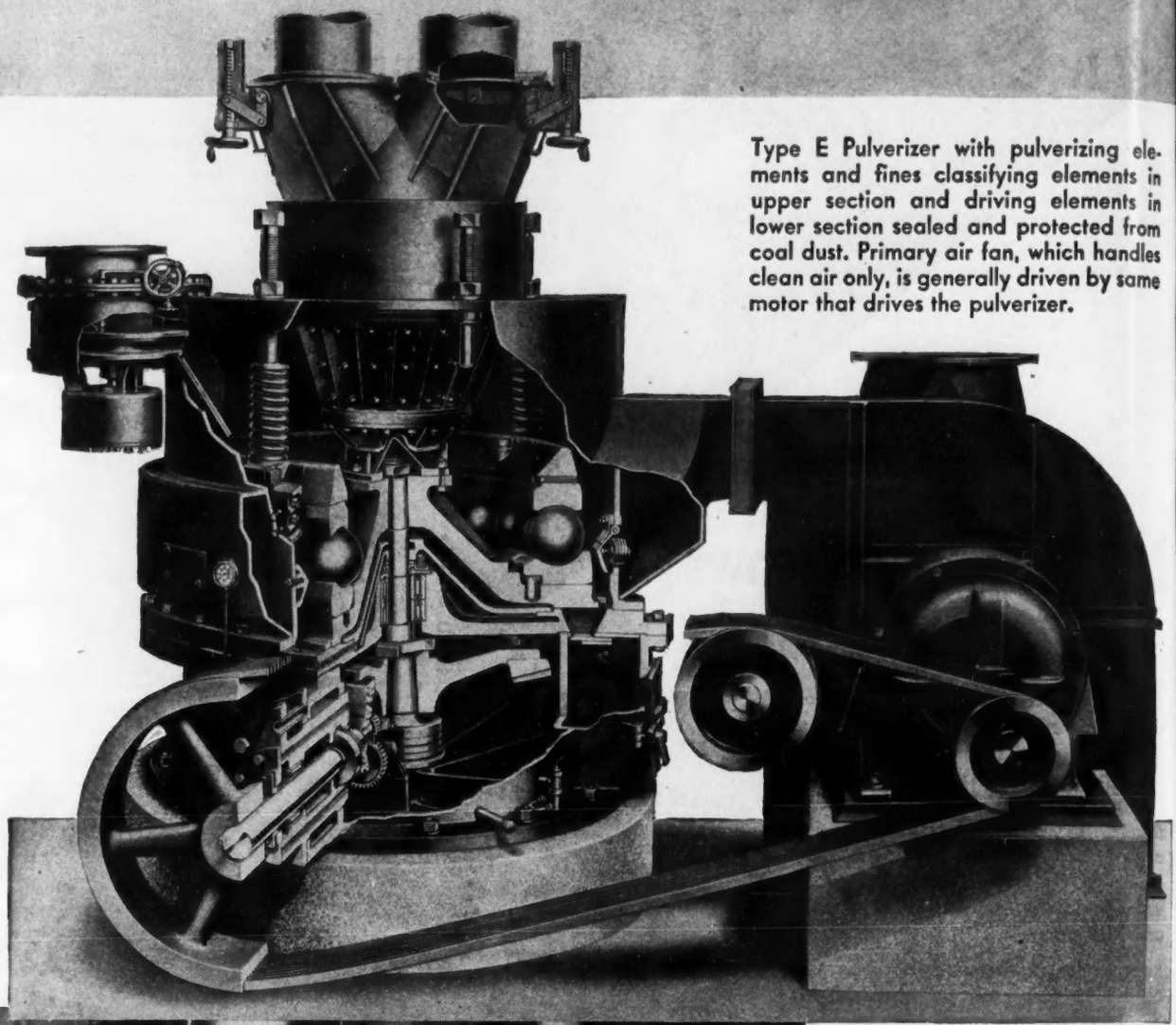
C-D products include THE PLASTICS . . . DILECTO—a laminated phenolic: CELORON—a molded phenolic: DILECTENE—a pure resin plastic especially suited to U-H-F insulation . . . THE NON-METALLICS, DIAMOND Vulcanized Fibre: VULCOID—resin impregnated vulcanized fibre: and MICABOND—built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.

DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C.
West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities

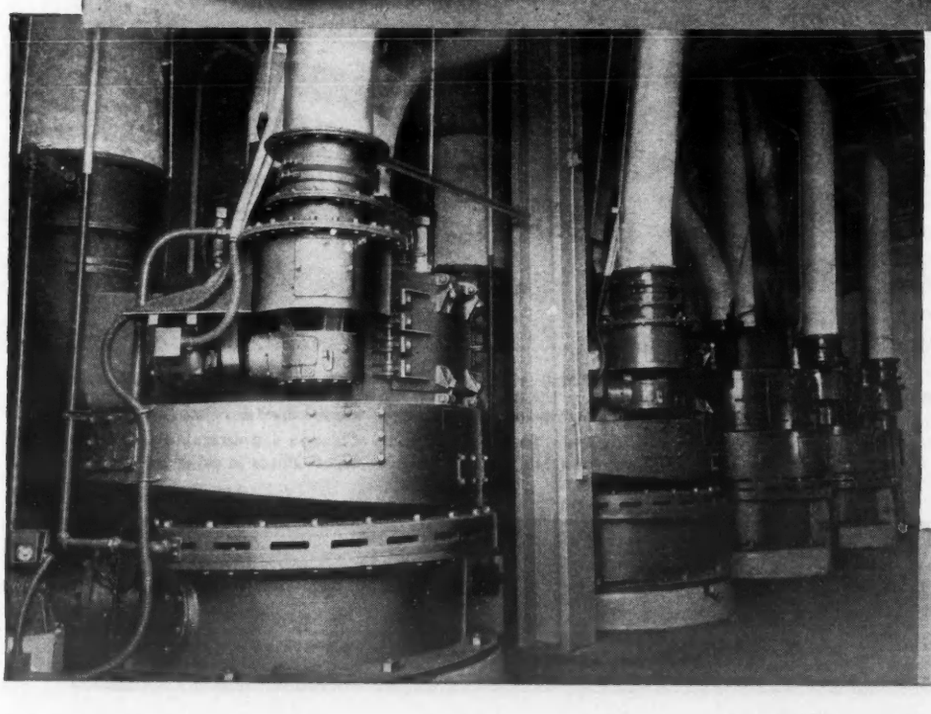
**Continental-Diamond FIBRE COMPANY**

*Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE*

# The B&W



Type E Pulverizer with pulverizing elements and fines classifying elements in upper section and driving elements in lower section sealed and protected from coal dust. Primary air fan, which handles clean air only, is generally driven by same motor that drives the pulverizer.



Over 400 Type E Pulverizers are i service or on order for direct firin boilers. Individual installations hav as many as 16 units.

# Type E Pulverizer

## ...ts into Any Day's Fuel Picture

### *Operates reliably and effectively in direct-firing pulverized-coal systems*

By every standard of direct-firing pulverizer performance, the Type E Pulverizer fits into the fuel economy picture any day, and especially so during the present emergency requirements.

**Type E Pulverizers—**

Are reliable in service and low in maintenance, as measured in service hours before replacement of parts becomes necessary.

Respond readily to load changes—output controlled at one point, the primary air damper, and are adoptable to fully automatic control.

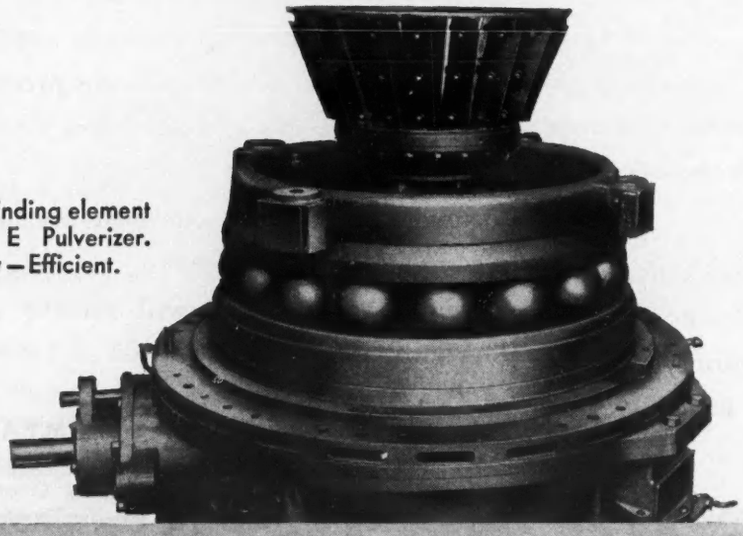
Maintain fineness and capacity throughout life of grinding elements.

Handle coal of a wide variety and, due to drying in the mill, can handle coal with as much surface moisture as it will carry.

These and other features of the Type E Pulverizer are given in more detail in Bulletin G-30-A. Copies obtainable on request.

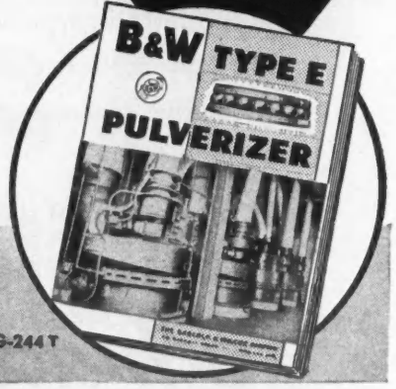
The Army - Navy "E" and Maritime Commission Award flags are floated proudly at the plant that builds Type E Pulverizers.

**THE BABCOCK & WILCOX COMPANY**
**85 LIBERTY STREET, NEW YORK, N. Y.**



...all-bearing grinding element ...f the Type E Pulverizer. ...imple – Sturdy – Efficient.

For a copy of this bulletin return this pasted on a penny post card with your name and address.




# BABCOCK & WILCOX

G-244T

## No. 3: Tips on Condenser Tube Maintenance

# How to reduce corrosion resulting from excessive organic and inorganic solids in the cooling water

In some locations, the power plant may be situated where more or less stagnant back-wash water is used for cooling. In such locations it is important that the basin from which the intake canal is fed be dredged clean at least once a year. Otherwise bacterial growth in decaying organic matter on the bottom of the basin may be drawn into the condenser, there to continue growth and decomposition.

This condition, in turn, causes local pitting and plug type dezincification. The tubes, under these conditions, should be frequently cleaned by blowing plugs through them.

Chlorination of the cooling water in the intake canal will kill the bacteria which cause harmful slime in the tubes. Where chlorination is practiced, the tubes will require very little mechanical cleaning, and corrosion due to these causes will be greatly reduced. Chlorine treatment has been successfully applied under the direction of concerns producing chlorine gas and sterilizing equipment.

A request on your letterhead for more complete information on prolonging condenser tube life will receive our prompt attention. 4398

**THE AMERICAN BRASS COMPANY**
General Offices: Waterbury, Connecticut
*Subsidiary of Anaconda Copper Mining Company*
*In Canada:* Anaconda American Brass Ltd., *New Toronto, Ont.*

ANACONDA

*Anaconda Condenser Tubes*

# *Dunco High-Inrush Load*

# RELAYS FOR AVIATION SERVICE

## SHOCK-TESTED . . . VIBRATION-TESTED . . . ALTITUDE-TESTED

Relays to match the ultra-exacting requirements of aircraft service are nothing new to Struthers Dunn, Inc. We've been making them for years—and each year has seen the development of units to set higher and still higher standards of performance and dependability in this field.

Dunco Aviation Relays receive numerous exacting tests in addition to those ordinarily applied to industrial types. They must perform in rarefied air as encountered at highest altitudes. They must withstand torturing shock, vibration, and acceleration. Their contacts must make, carry, and break currents far greater than they will encounter in normal service. Some tests require thousands of amperes at 24 volts direct current. Typical units of less than 1⅓ lbs. are required to develop contact pressures comparable to those of industrial contactors weighing 100 lbs. or more. *They do not fail!*

### HERE IS YOUR GUIDE TO RELAY SELECTION AND USE

Write for your copy of the Dunco Relay Catalog and Data Book. It contains complete information on relays, timers, and solenoids for a wide variety of applications, as well as helpful data on their proper selection and use.

# STRUTHERS DUNN, Inc.

**1321 ARCH STREET, PHILADELPHIA, PA.**

*DUNCO DISTRICT ENGINEERS IN 28 CITIES WILL HELP SOLVE YOUR RELAY-TIMER PROBLEMS*

# ILLINOIS

## *High Tension Gooseneck Porcelains for Transformer Entrance Wires*

• Accuracy in control of production of ILLINOIS Porcelain assures exact dimensions plus high mechanical and high dielectric strength for perfectly balanced insulators. All sizes and shapes are available for high tension transformers of every type—ease of installation assured because of uniformity —right fit means dependable service.

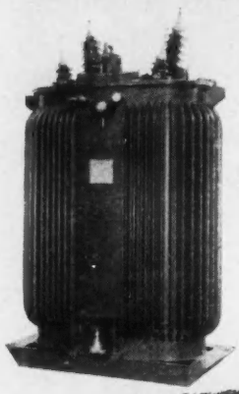
**ILLINOIS ELECTRIC PORCELAIN CO.,** *Macomb, Illinois*

# WHEN DELIVERIES ARE *Urgent* . . . HERE'S WHAT WE CAN DO

When you need transformers in a hurry — call on Pennsylvania. We are able to quote excellent deliveries on all types of transformers.

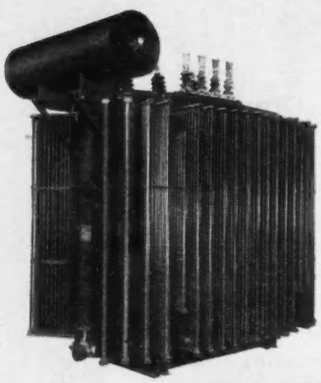
We repeat what we have said personally to many of our customers; "It is our policy never to take on more work than we can handle efficiently." This means that the quality of our transformers will not be impaired by quick deliveries.

If you have any transformer problems that need quick action — get in touch with us immediately. Make use of our ability to work quickly and get things done right.



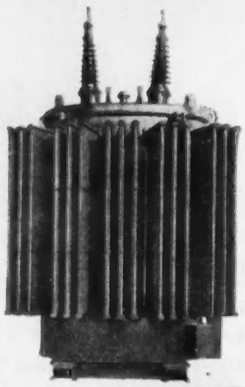
667 KVA
25 KV

**21 DAYS** OR BETTER



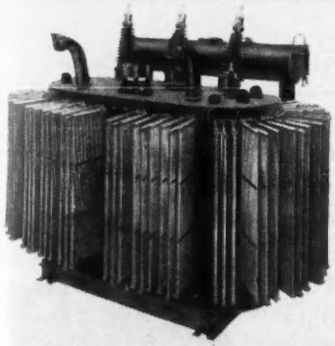
5000 KVA
34.5 KV

**35 DAYS** OR BETTER



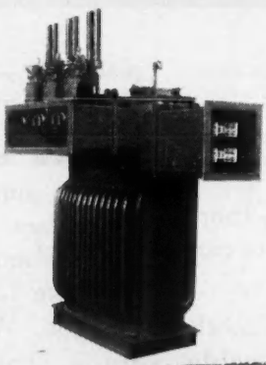
10,000 KVA
66 KV

**45 DAYS** OR BETTER



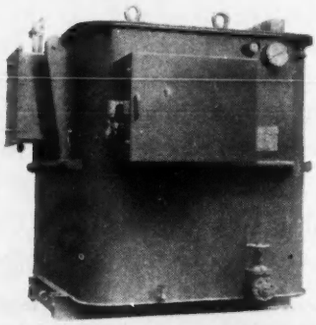
20,000 KVA
115 KV

**55 DAYS** OR BETTER



INDUSTRIAL TRANSFORMER UNIT SUBSTATION TYPE 300 KVA

**21 DAYS** OR BETTER



FURNACE TRANSFORMER 7500 KVA WITH MOTOR - OPERATED TAP CHANGER.

**45 DAYS** OR BETTER

**WRITE FOR FREE COPY**

of our 9 x 12, 3 color, Army & Navy Insignia Wall Placard. It includes Branch, Corps, and Division Insignia.

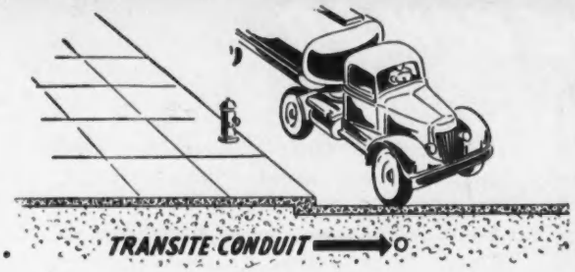
★

**Pennsylvania**
**TRANSFORMER COMPANY**
PITTSBURGH, PENNSYLVANIA

Pennsylvania TRANSFORMERS

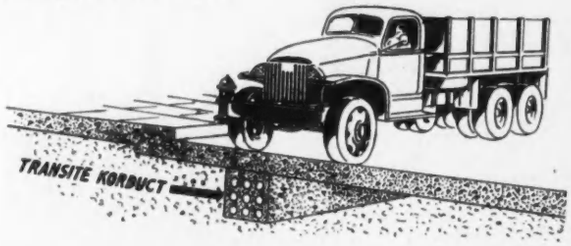
# WHY *TWO TYPES* OF *TRANSITE DUCTS*?

**For Use Without a Protective Envelope . . .**

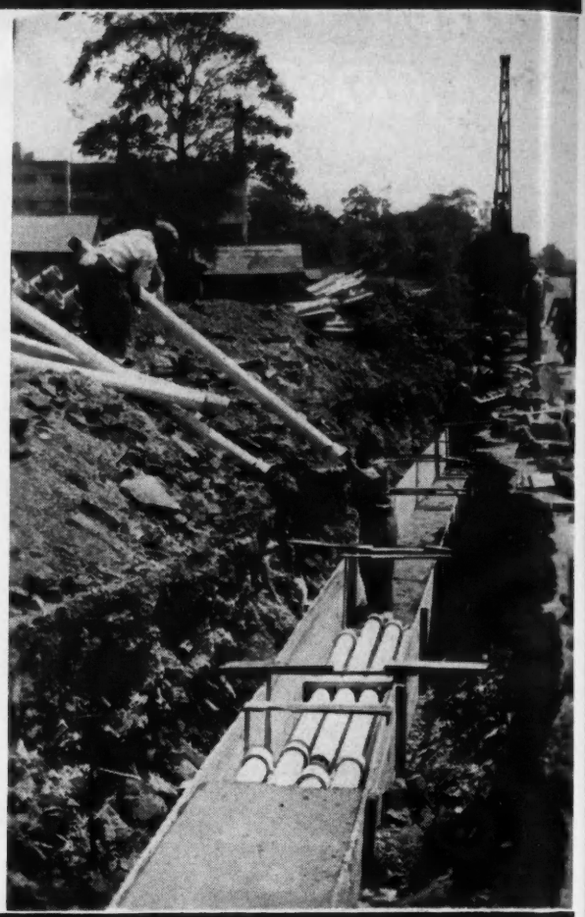



**Transite Conduit saves on labor and material, for it is so strong it needs no protective casing. It maintains its strength and true form under heavy earth loads and traffic pressure. Can't rot . . . effectively resists soil corrosion, smoke and fumes.**

**For Use With a Protective Casing . . .**




**Transite Korduct is thinner walled, lower priced, otherwise identical with Transite Conduit. Its long lengths mean fewer joints, fewer spacers. And its unusually high rate of heat dissipation lowers cable operating temperatures, boosts system capacity.**



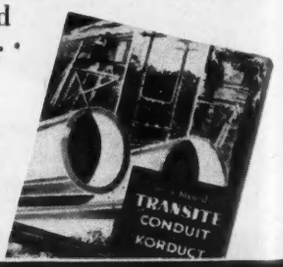
## BOTH THESE DUCTS PROVIDE THESE ADVANTAGES AS WELL . . .

***1. Minimize fire hazard***—Transite Ducts cannot burn because they are made of asbestos and cement. They will not contribute to the formation of explosive or combustible gases.

***2. Eliminate electrolysis problem***—Inorganic and non-metallic, Transite Ducts can never be affected by electrolytic action.

***3. Make cable pulls easy***—The smooth bore of Transite Ducts speeds up cable installation. Because the ducts stay smooth in service, cables can be removed and replaced at any time with virtually no damage to sheathing.

***4. Save time on installation***—Light in weight, supplied in long lengths, Transite Ducts are so easy to assemble that only the minimum of time and expense is required for any job. Write for Data Book DS-410, Johns-Manville, 22 E. 40th St., New York, N. Y.

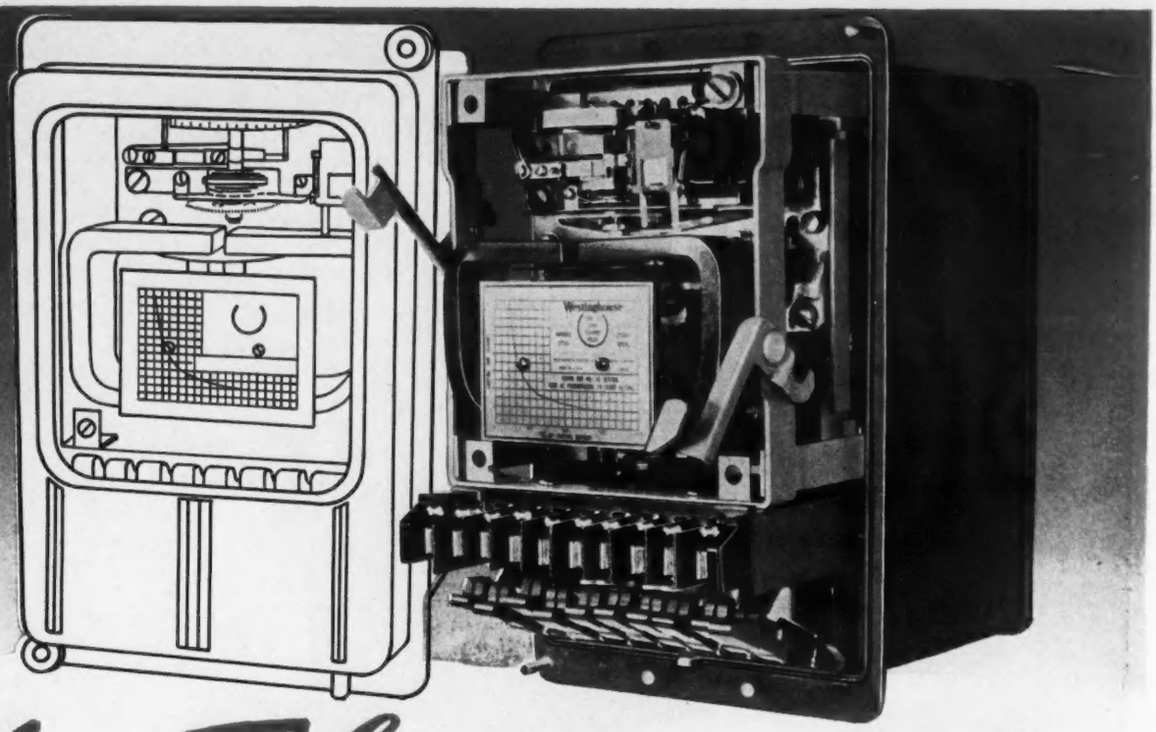



JM Johns-Manville

# TRANSITE DUCTS

**TRANSITE KORDUCT**— for installation in concrete

**TRANSITE CONDUIT**— for exposed work and installation underground without a concrete encasement



# New Flexitest relay

## COMBINES RELAY AND TEST SWITCH IN ONE CASE

In the Flexitest Relay, Westinghouse combines both relay and knife-blade test switches in one compact mounting. This makes routine testing and maintenance simpler and more dependable by assuring:

### FLEXIBILITY

Knife-blade test switches and removable unit chassis make possible checking either in or out of the case using clip leads or a test plug.

### RELIABILITY

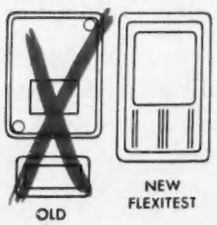
Present standard relay elements with high-capacity, self-aligning knife-blade switches, positive short-circuiting devices and trip circuit interlocks assure reliable performance and testing.

### VISIBILITY

Knife-blade switches mounted at the front with the circuit identification cards give clear view of all connections under both normal and test conditions.

Open-type chassis construction provides for easy inspection of elements when chassis is removed.

### SAVINGS IN PANEL SPACE—MATERIAL—TIME




The combined relay and test switch requires less panel space than separately mounted units, reduces number of connections and panel wiring. J-40337

## IT ALL ADDS UP

**VISUAL INSPECTION.** Operating parts are clearly visible. When relay is withdrawn, all parts are accessible for inspection or maintenance.

+ **TESTING FLEXIBILITY.** Each circuit can be tested independently by means of clip leads or ten circuit test switches. Elements may be tested either in or out of the case.

+ **RELIABLE OPERATION.** All test circuits are *in front* where they can be seen. High-capacity, knife-blade test switches are self-aligning and give wiping action.

+ **COMPLETE SAFETY.** Short circuiting of current transformer secondaries is automatic. Relay cannot be removed without opening the trip circuit interlocking switch.

= **FLEXIBLE, VISIBLE, RELIABLE TESTING.**

**Westinghouse**

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

**FLEXITEST RELAYS**

● There is glamor in the glass that houses the electronic miracle of fluorescent lamps. These long light sources provide the cool, shadowless, glarefree illumination that works a "charm" in speeding war production in plants all over America.

There is glamor, too, in the careful "beauty salon" treatment of glass at Sylvania. Before acceptance it undergoes 16 different inspections for possible imperfections. It is handled with gloves — to avoid possible contamination from contact with human hands. It is even washed, dried, brushed, and vacuum-cleaned in air-conditioned rooms.

Sylvania "glamor glass," like the development of the "Mercury Bomb" method of precise mercury measurement, is a formula that conserves vital metals for war. But all the material and process changes, made continually at Sylvania, must and do step up fluorescent performance and effect important economies.*

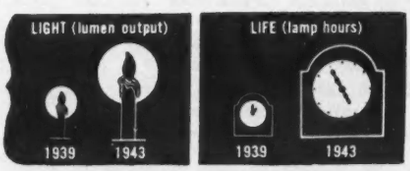
It is because of Sylvania's many years of independent and aggressive research that fluorescent, today the best industrial lighting, is destined to light our homes, offices and stores when Victory is won.

To obtain research dividends of more light output, longer life and uniform color, specify Sylvania Fluorescent Lamps — each one better than the last — for replacements.

**SELL SYLVANIA AND GIVE YOUR CUSTOMERS FAR MORE LIGHT AND LIFE FOR THEIR MONEY**

*Compared with 1939 a dollar invested today in Sylvania Fluorescent Lamps buys more than four times the lumen output and approximately five times the lamp life.

SYLVANIA FLUORESCENT DOLLAR BUYS:




(Based on decreasing price and increasing efficiency and durability of Sylvania 40-Watt White Fluorescent Lamp)

# SYLVANIA

## ELECTRIC PRODUCTS INC.

Formerly Hygrade Sylvania Corporation
Salem, Mass.

*Incandescent Lamps, Fluorescent Lamps, Fixtures and Accessories, Radio Tubes, Electronic Devices.*

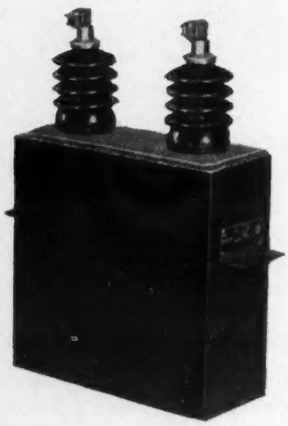
# *Appendectomy with a teaspoon*

Acute appendicitis!

A shipmate writhing in agony.

The Pharmacist's Mate had watched dozens of appendectomies. But he'd never performed one. And there they were, miles from shore—in enemy waters. And no proper instruments. He had to operate—using a teaspoon as a surgical clip. He had only cool courage, steel nerves and a trustworthy memory, to guide him in performing this operation.

Naturally, if appendicitis struck, and you had your choice, you'd call in a specialist — the best to be had. In industry as well as surgery, it is sound practice to seek a specialist. Here at C-D we are not surgeons. But we are specialists in the field of capacitors. We have the 'know-how' that comes from experience — thirty-three years of building capacitors — and capacitors only. Whatever your system problem, our engineers will be glad to assist you. Cornell Dubilier Electric Corp., So. Plainfield, New Jersey.



***Pole-Mounting C-D Capacitor***

Illustrated is a 15 Kva., 2,400 Volt, single phase, 60 cycle, Dykanol, individual outdoor, capacitor unit.

Because of the compact construction and durability of these capacitor units they can be mounted singly or in multiple combination, on pole cross-arms. They are extensively used by leading systems and industrial plants for power-factor improvement at critical load points. For complete details write for Catalog No. 143C.

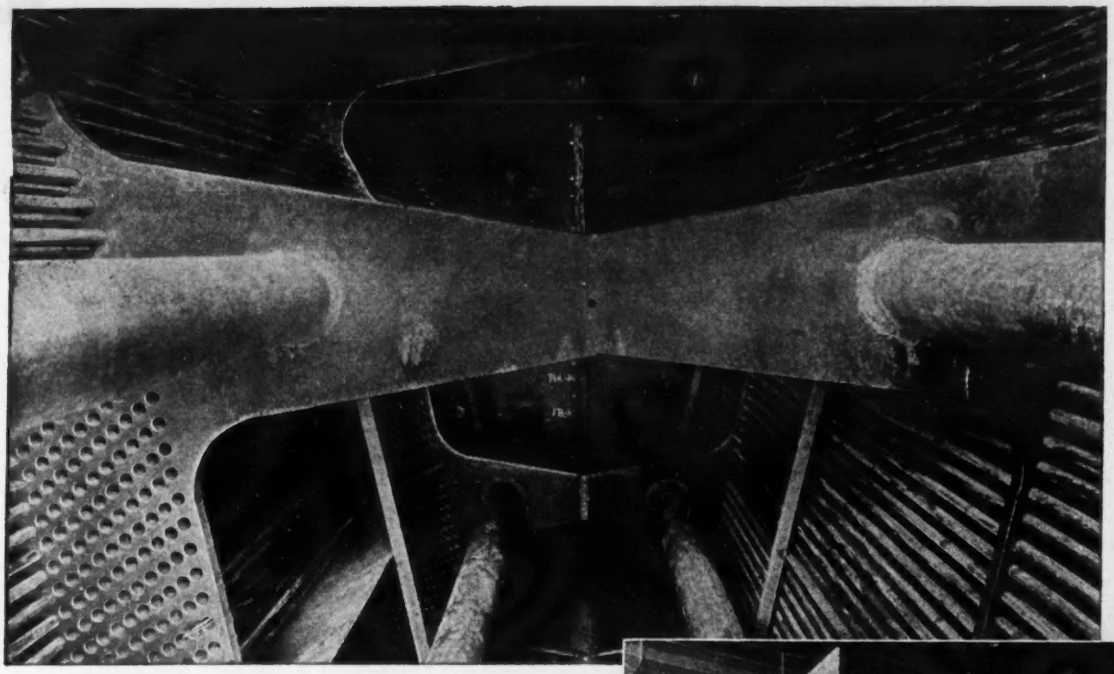
**THERE ARE MORE CORNELL-DUBILIER CAPACITORS IN USE TODAY THAN ANY OTHER MAKE***

REG U S PAT OFF

# *Cornell-Dubilier*

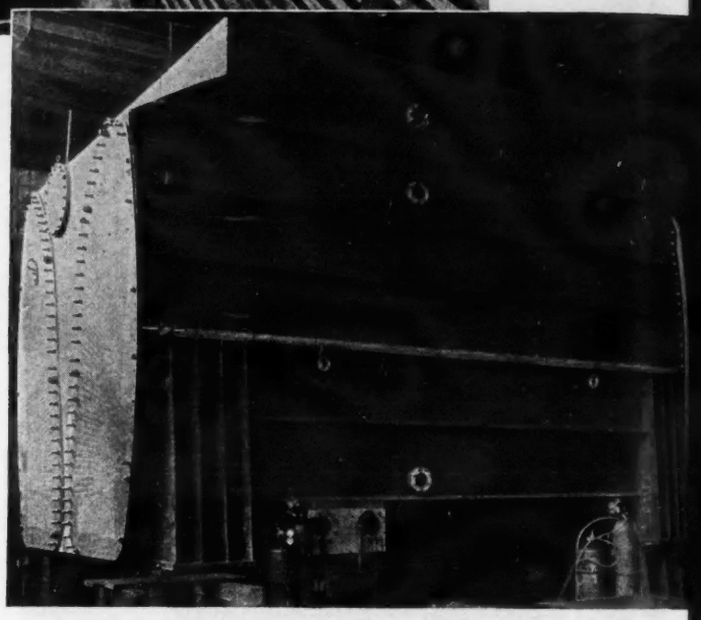
## *capacitors* *for power-factor improvement*

*INCLUDING ALL APPLICATIONS



*Left*—Large ce
tral steam spa
dividing conde
ing tubes into t
shallow banks.

*Below*—40,000 sq.
single pass cros
flow condens
Row of studs ou
lines rectangul
tube banks.



# CROSS FLOW CONDENSER

## HIGH-VACUUM LOW CONDENSATE DEPRESSION

Efficient condenser performance depends primarily on maintenance of high vacuum and low condensate depression. Foster Wheeler cross-flow construction achieves these objectives through design characteristics:

1. Large central steam space provides effective steam distribution over condensing surface. Considerable steam is at once condensed, thus reducing velocity and pressure drop through remainder of tube bank. This open steam circulation also effects positive heating of condensate. Length of steam travel to and through shallow tube banks is shortened affording easier, quicker condensation.
2. There are no dead zones and no overloaded zones. Tubes are spaced on straight lines converging in the direction of steam flow thus maintaining a steadier steam velocity and equalizing pressure drops throughout.
3. Condensate is drained off outside of tube areas by sloping baffles parallel to steam flow. This prevents excessive cooling of condensate, which otherwise would fall through tube bank, clogging the area with resultant increase in pressure drop and decrease in heat transfer.

**FOSTER WHEELER CORPORATION • 165 BROADWAY, NEW YORK, N. Y.**

**FOSTER WHEELER**

*In time of war and in time of peace . . .*

# Wagner

## TRANSFORMERS

reflect sound engineering and modern manufacturing methods . . .

**POWER**
★
**DISTRIBUTION**
★
**AIR-COOLED**
★
**NOFLAMOL**
(NON-INFLAMMABLE LIQUID FILLED)

★

*Write*
FOR BULLETINS
TU-33 (NOFLAMOL)
TU-181 (POWER)
TU-180 (DISTRIBUTION)

T43-3.

Wagner Electric Corporation
ESTABLISHED 1891
6400 Plymouth Avenue, St. Louis, Mo., U. S. A.
ELECTRICAL AND AUTOMOTIVE PRODUCTS

# The FIRST SILVER-GRAPHITE CONTACT ever molded from powders

## . . . was a Stackpole product

Almost two decades have passed since Stackpole revolutionized circuit breaker and control equipment performance by producing a molded silver-graphite contact, at the suggestion of Westinghouse engineers, which enabled a 50 ampere continuous-rated unit to handle 5,000 amperes on a short circuit.

Since then, molded contact developments have come thick and fast—and Stackpole engineering has continued to lead the field. Today, Stackpole offers a complete line for practically any application. Equally important is the wealth of contact engineering experience that is available to Stackpole customers. Whether your problem be one of contact design, attaching the contact to the arm, or re-designing the equipment itself in order to assure utmost contact efficiency, Stackpole engineers have the answers!

**STACKPOLE CARBON COMPANY, ST. MARYS, PENNA.**

**TYPICAL STACKPOLE MOLDED PRODUCTS**

Brushes and Contacts
(All carbon, graphite, metal and composition types)
Rare Metal Contacts
Bearings
Welding Rods, Electrodes, and Plates
Powdered Iron Metallurgy Components
Anodes
Electrodes
Brazing Blocks
Molded Carbon Pipe
Rheostat Plates and Discs
Brake Lining
Packing
Piston and Seal Rings
and numerous others

**STACKPOLE ELECTRONIC COMPONENTS**

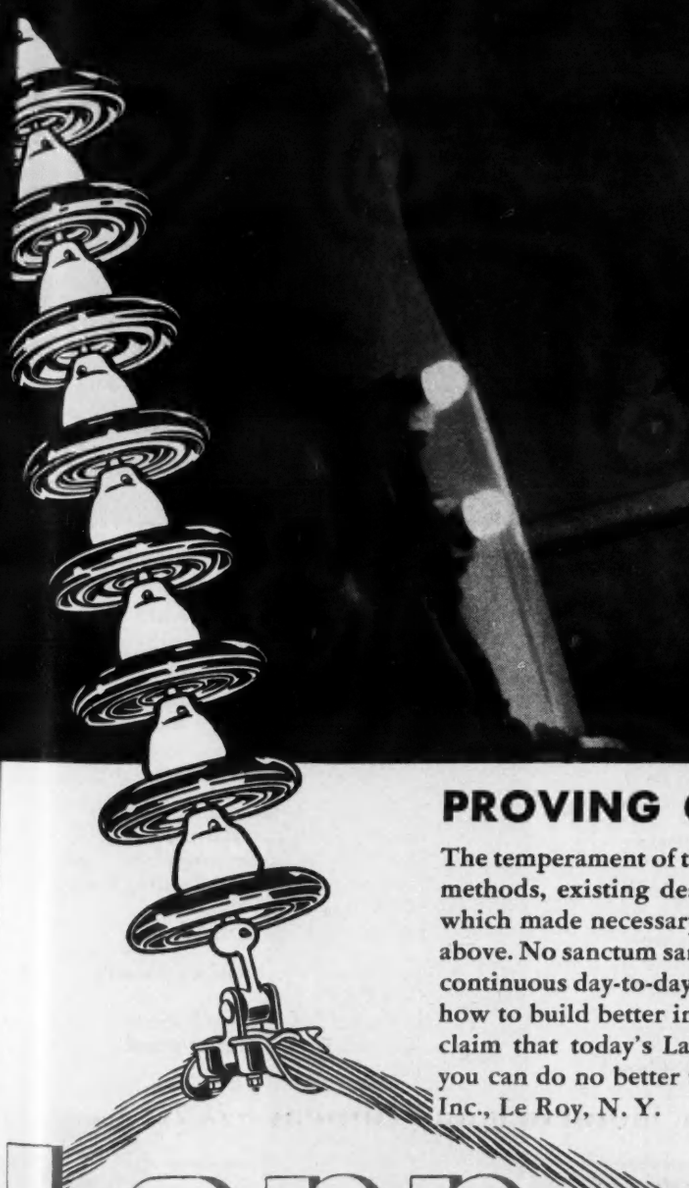
Fixed and Variable Resistors
Molded Iron Cores
Switches

# STACKPOLE

## MOLDED METAL CONTACTS

Silver-graphite . . . Silver-copper-graphite . . . Gold-graphite . . . Silver-nickel . . . Silver-molybdenum
Silver-tungsten . . . Silver-nickel-molybdenum . . . Silver-nickel-tungsten and dozens of special alloys

T'S THE *PORCELAIN* THAT INSULATES



## PROVING GROUND FOR INSULATORS . .

**The temperament of the Lapp organization is that of dissatisfaction with existing methods, existing designs. It is this spirit which produced the Line Post and which made necessary the Lapp laboratory, a corner of which is photographed above. No sanctum sanctorum, this laboratory is truly an engineers' workshop, in continuous day-to-day use, testing, discarding, proving new designs. As we learn how to build better insulators, we build them. Meanwhile, we feel secure in our claim that today's Lapp insulators are adequately suited to today's needs, that you can do no better than to insulate your lines with Lapp. Lapp Insulator Co., Inc., Le Roy, N. Y.**

ARMY E NAVY

# Lapp

*Better Porcelain • Better Insulators*

**They work together better . . .**
**because they can talk together**

From a thousand feet up
The burning airdrome
Looks like
A "pushover" . . .

But
When you get
Right down to earth
It turns out to be
Anything but.

Suddenly the trees
To the right
Start throwing lead —
And your men
Are still hanging
Like clay pigeons
In their harnesses.

* * *

What a break
That you're equipped
With a
Two-way
Radio.

What a break
That you can tell your trouble
To a friendly
Fighter plane.

* * *

Today, communication equipment
Designed and manufactured
By I.T.&T. associate companies
Is helping Uncle Sam's fighting forces
Work together
On land, sea and in the air . . .

Tomorrow, the broad experience
Of I.T.&T.
In the field of communications
Will help build a better world
For every man.

**INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION** *67 Broad St., New York, N. Y.*

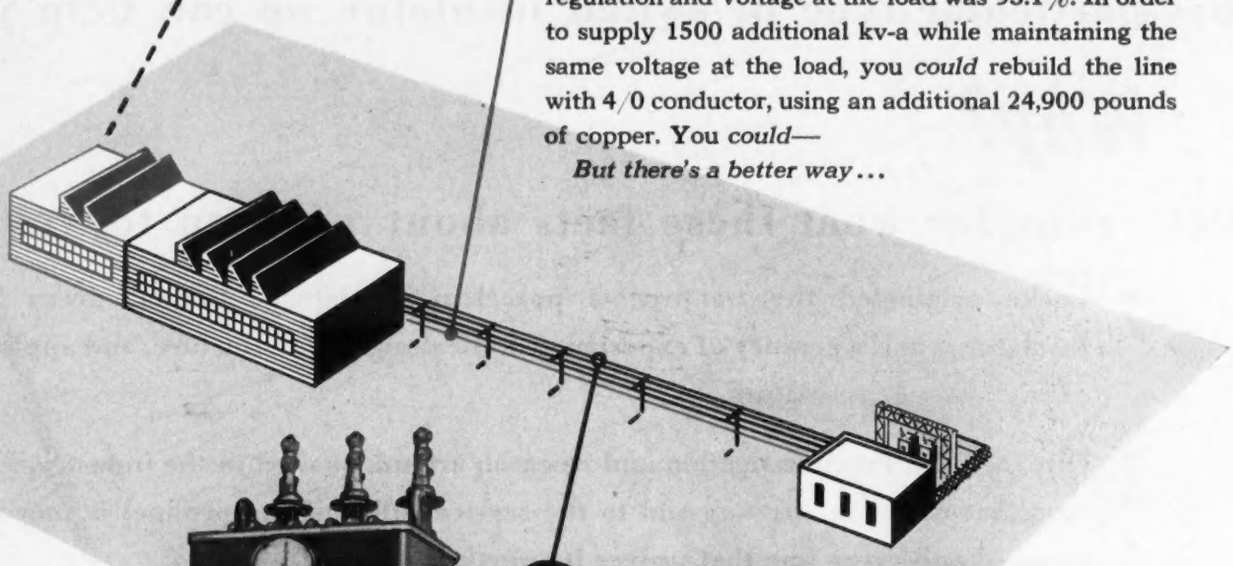
**I T&T**

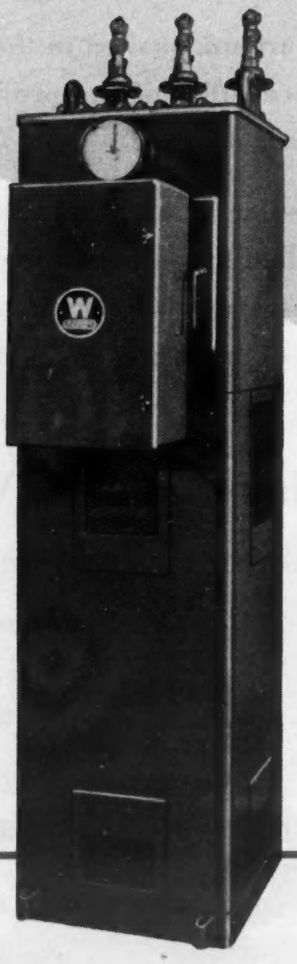
*Manufacturing Associate:*
FEDERAL TELEPHONE AND RADIO CORPORATION

# which solution would you choose?

**A** **BUILD A NEW LINE—REQUIRING 24,900 POUNDS OF COPPER.** That's one way to supply the 1500 additional kv-a required for this plant expansion. Former load of 4500 kv-a was supplied by a 13.8 kv line, five miles of 1/0 conductor. There was no line regulation and voltage at the load was 93.1%. In order to supply 1500 additional kv-a while maintaining the same voltage at the load, you *could* rebuild the line with 4/0 conductor, using an additional 24,900 pounds of copper. You *could*—

*But there's a better way...*



Westinghouse builds a complete line of feeder voltage regulators for all types and sizes of distribution lines. Step type regulators for outdoor service . . . liquid-cooled induction type regulators for outdoor and indoor service . . . air-cooled (illustrated) for indoor service.

**B** **USE FEEDER VOLTAGE REGULATION—REQUIRING 1470 POUNDS OF COPPER.** In the example illustrated, feeder voltage regulators using only 1470 pounds of copper would make available the additional 1500 kv-a needed. The same voltage would be maintained at the load, and voltage conditions generally would be improved. Today, more than ever before, this is the right solution for the problem of expanding power requirements.

When you have the problem of supplying more power for plant expansion, remember this simple comparison of two possible methods. Get Westinghouse recommendations on copper-saving applications of voltage regulators. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pennsylvania. J-10237

**Westinghouse**

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

**VOLTAGE REGULATORS**

# Which switch insulator for my job . . . ?

**If you are ever troubled by conflicting claims for this or that particular type of switch insulator we can help you.**

## Why?

**Well, consider what these facts about *us* mean to *you* . . .**

1 **Locke originated the wet-process porcelain insulator. Behind every Locke insulator is half a century of experience in the design, manufacture, and application of high-voltage insulators.**

2 **Our facilities for investigation and research are unequalled in the industry. Every idea that might in any way add to the serviceability of the product is thoroughly checked and every one that proves its worth is adopted.**

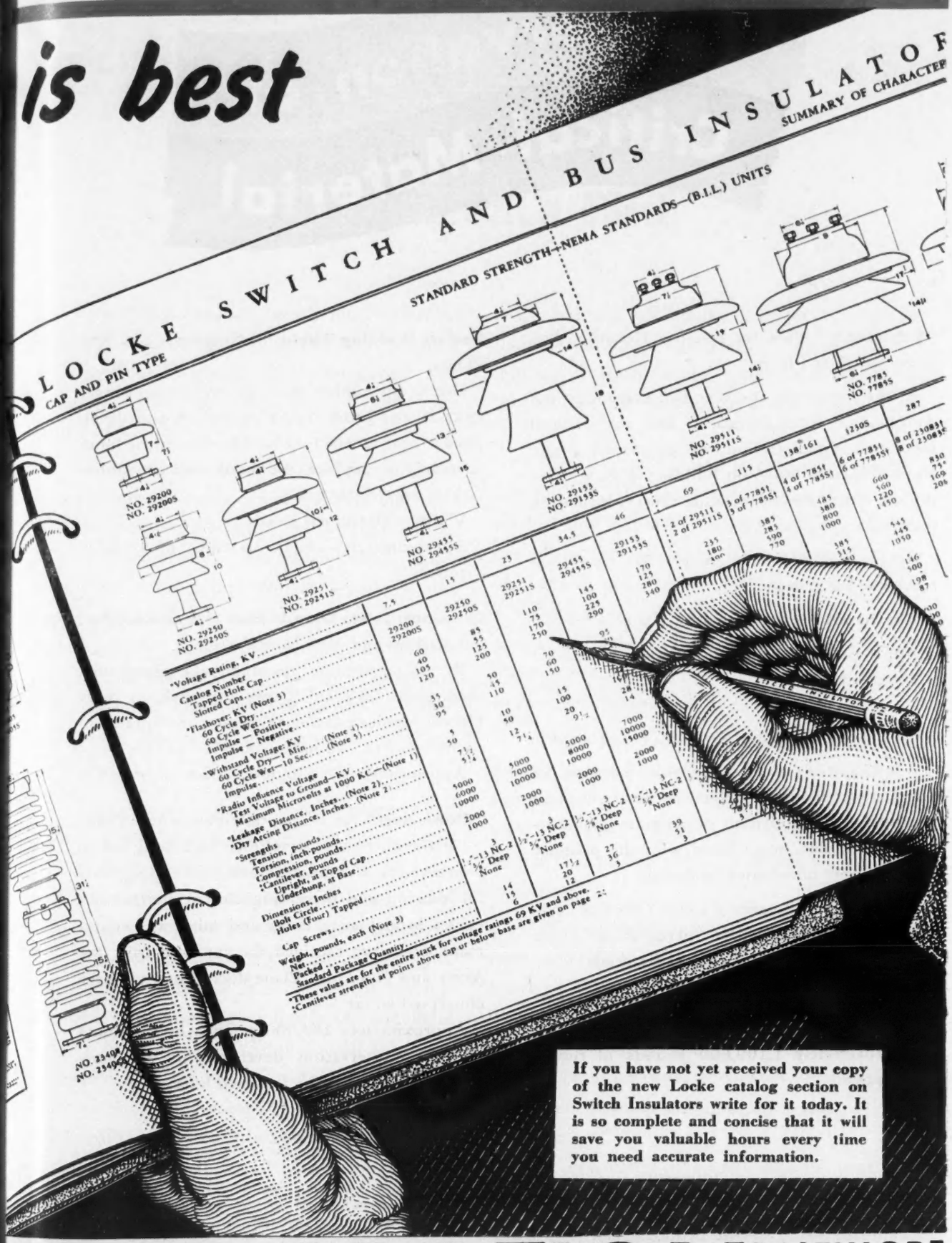
3 **The manufacturing capacity of the Locke Insulator Corporation is the largest in the world—which means that we are not compelled by physical considerations to limit our production. In the interests of our customers we frown on duplication but, where competent investigation shows the need for a particular design, that design is perfected, manufactured and offered.**

**We hold no brief for any type of insulator as such. Which is why we can honestly and candidly give you the full facts on all types**

**. . . and, what is equally important to you—millions of Locke Insulators aiding the all out war industry today on transmission and distribution lines, generating plants and railroad electrifications, were installed years before World War I.**

# LOCKE INSULATOR

# is best




If you have not yet received your copy of the new Locke catalog section on Switch Insulators write for it today. It is so complete and concise that it will save you valuable hours every time you need accurate information.

# CORPORATION BALTIMORE MARYLAND

# Conservation of Critical Material

**"Rub-r-Less" Wire** for Defense Housing, Airports and War Plants.

At the request of the War Department—Civil Aeronautics Administration, and the Federal Housing Administration, we developed a safe and satisfactory 600 Volt Building Wire without the use of tin, rubber, or other critical insulating material.

Because of this development, we have conserved so far:

Approximately 1500 pounds of tin

Approximately 2,300,000 pounds of rubber compound

**"Rub-r-Less" Hose** for Civilian Fire Protection

The Office of Civilian Defense in working out the Stirrup Pump problem necessary for the protection of the civilian population against incendiary bombs, were faced with the problem of using only non-critical materials.

Produced and presented to the Office of Civilian Defense a satisfactory Stirrup Pump Hose, made without the use ot critical materials.

In the production of National "Rub-r-Less" Hose, conserved so far:

Approximately 1,100,000 pounds of rubber compound

**Electric Welding Cable** for Shipyards and War Plants

Due to the rubber shortage, we changed over much of our loom-weave equipment and developed a most satisfactory hard surface fabric loom covering to replace the hard surface rubber jackets on electric cables.

We have conserved so far:

Approximately 15,500 pounds of CRUDE rubber

**Terminal Tube Gland Nuts** for Battleships, Submarines and Merchant Vessels

By unique design "terminal tube gland nut" used with Terminal Tubes for packing Navy Electric Cables passing through watertight compartments, etc., we have conserved so far:

Approximately 2,400,000 pounds of brass

**"Plane-duct"** for Bombers, Fighters and Tanks

"Plane-duct" was developed and designed to conserve the aluminum interlocked tubing used for housing and protecting electrical wires and cables in airplanes, tanks and other war equipment. Since we received the approval from the Army and Navy for "Plane-duct's" use, we have conserved so far:

Approximately 280,000 pounds of aluminum

Other conservation developments are now under way and will be reported later.

★ ★ ★ ★ ★ ★ ★

NATIONAL ELECTRIC PRODUCTS NE 6 WIRES AND CABLES

**National Electric Products Corp.**

Pittsburgh, Pa.

# Fluorescent's Fifth

Five years ago this month the fluorescent lamp came on the market just in time to catch the two World's Fairs—New York and San Francisco—with the suggestion of the light source of the morrow.

Fluorescent caught the public fancy in the very beginning because it was modern, but more than that because it would "cut the light bill in half." Compared to the incandescent lamp, fluorescent sources are efficient, and in our opinion we have seen "only the beginning" in that direction. That isn't the big thing, however, about fluorescent. The most important contribution of this new light source is that it provides a means for getting more light and better light.

Incandescent lighting for most interiors had a general illumination ceiling of 50 foot-candles. Beyond that point we got discomfort. Fluorescent lighting has already taken us comfortably to twice that level and beyond. There is nothing at the moment to prevent it from going higher except the difficulty the industry has in convincing itself that these higher levels are beneficial and can be sold. That, however, will take care of itself and, if the evolution in thinking in the next five years equals that of the past five, 100 foot-candles of general illumination will be very common practice.

This, then, takes us to the post-war era, when fluorescent lighting will get going in a really big way. Without any desire to minimize its importance in war industries, one cannot help looking forward to the time when a million tubes a day instead of a week will be the order.

How long will it take to get to that production figure? We haven't the slightest idea, but we do know that after the war fluorescent offers the means for relighting the interiors of America. We do know that this job alone will absorb a lot of people. We also know that every new post-war advance in lighting practice will render obsolete everything before it. That wasn't quite so true with incandescent.

There are around 30 million fluorescent lighting outlets in the United States on the lamp's fifth birthday. Will there be 100 million on the tenth birthday? If the war doesn't last more than a year or two longer, will that be too much to expect?

This seems much too conservative to us, but even so let us think for a minute of the dollars involved in one fluorescent outlet—tubes, accessories, reflector, wiring materials, labor. Multiply that by the 70 million or more new outlets by the tenth anniversary and one can see that fluorescent lighting has given us a rich post-war opportunity.

Markets, employment, better lighting, greater service to the public—that is fluorescent's post-war promise on its fifth birthday.

# Oilostatic Cables for 13.8-Kv. Generator Leads

***Favorable experience with 132-kv. installations prompts adoption for generator leads to simplify run through the plant basement to step-up bank***

***F. P. FAIRCHILD, Chief Engineer Public Service Electric & Gas Company***

CONGESTION of existing structures along the most feasible route for an overhead transmission line from the step-up transformers, installed just outside the station wall, to the 132-kv. switching station at one of the generating stations of the Public Service Electric & Gas Company, New Jersey, led to the installation of Oilostatic cable. This installation was described in detail in the ELECTRICAL WORLD of February 22, 1941, as made for the two runs associated with the initial 125,000-kw., 144,000-kva. cross-compound turbo-generator. A similar installation of 132-kv. Oilostatic has since been made for a second unit at this location.

On the basis of the experience with the initial 132-kv. Oilostatic cable two of the generating stations of this company now also employ Oilostatic cables for the 13-kv. generator leads from newly installed generators. The decision to employ this type of installation for generator leads in both locations was to avoid obstacles to duct runs or overhead cable racks and to avoid the use of large single-conductor cables.

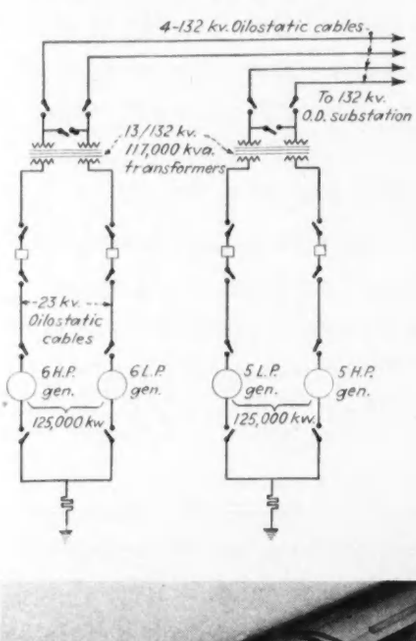
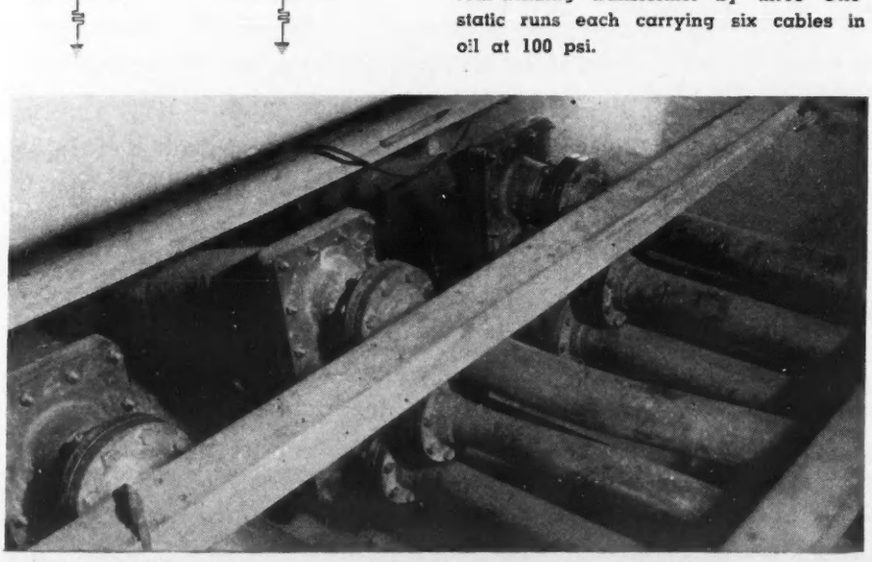



**FIG. 1—Two generators driven by high- and low-pressure turbines connected to a four-winding transformer by three Oilostatic runs each carrying six cables in oil at 100 psi.**

Relative absence of steam pipes and hot auxiliaries at one of two stations utilizing Oilostatic generator cables made it practicable to run the line in the open basement, with a considerable saving in copper, whereas at the other station it was necessary to bury the runs in the ground. Consequently each of the 18 conductors used for each of the two generators making up the new compound unit at the former location is of 750,000 cir.mil size, whereas for an exactly similar generator at the other location each cable is of 1,250,000 cir.mil size. The difference in size in favor of the installation run in air is accounted for by the heat from the cable being carried away more rapidly in the air than in the ground. In both cases the large pipe affords a favorable heat-dissipating surface in conjunction with the conduction and convection contributed by mass of oil.

This unique application of low-volt-



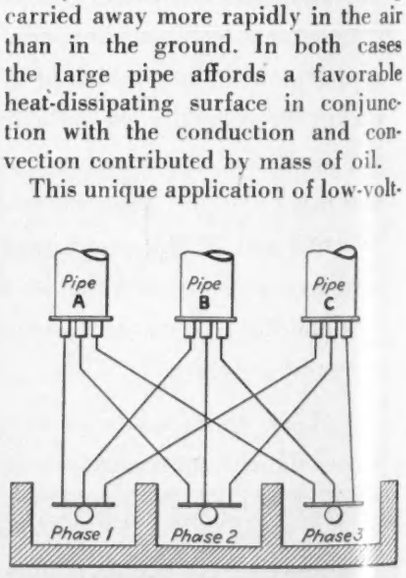



**FIG. 2—Leads emerging at base of generator driven by high-pressure turbine. (Right) Each pipe carries six cables, two per phase and each pair in an intervening copper pipe**

age Oilostatic cable follows six to seven years of reported favorable experience with high-voltage lines on a neighboring utility and railroad. There had also been several months operating experience with the initial pair of Oilostatic installations.

The main runs of the Oilostatic cable are made in steel pipe in which cables connected to each of three phases are drawn. Since there are three such steel pipes for each of the two generators making up the compound unit (Fig. 1), it is necessary to separate the phase leads and bring them to the proper phase compartment under the generator terminals (Fig. 2). This is accomplished by connecting three copper or brass pipes to the ends of each steel pipe. This arrangement is duplicated on the transformer end (Fig. 3). The step-up for each transformer bank of each compound unit is a four-winding transformer with two 13-kv. primaries (one for each generator) and two 132-kv. secondaries (each feeding out over one of the 132-kv. Oilostatic cables to the 132-kv. switchyard) on the same common magnetic core. This arrangement obviated the 13-kv. bus and in addition simplified satisfactory relaying of the system.

### *Leads Are Split*

In order to keep the size of the individual cables within bounds and to take advantage of the more efficient use of copper in smaller sizes, the phase leads in each Oilostatic steel pipe for generator leads are divided into two conductors. There are thus six insulated conductors in each steel pipe, two for each phase, and three such steel pipes for each generator, thus making 18 cables from each generator (Fig. 2) to the transformer, or 36 cables total for the cross-compound unit. Two cables of the same phase in each steel pipe are run in a single copper or brass pipe as the eddy current losses in steel pipe would be prohibitive.

While the use of three Oilostatic runs in parallel was determined largely to keep down the size of the individual cables, it has the added advantage that in case of a fault in any one cable it can be isolated from the others, thus avoiding the loss of the entire generator capacity. As a matter of fact, because of differences in heat dissipation, two of the Oilostatic runs will carry considerably more than two-thirds of what the three Oilostatic runs will carry, and if the two outside runs are those remaining in service there is a further slightly higher capacity available than if one outside and the middle Oilostatic runs remain in service.

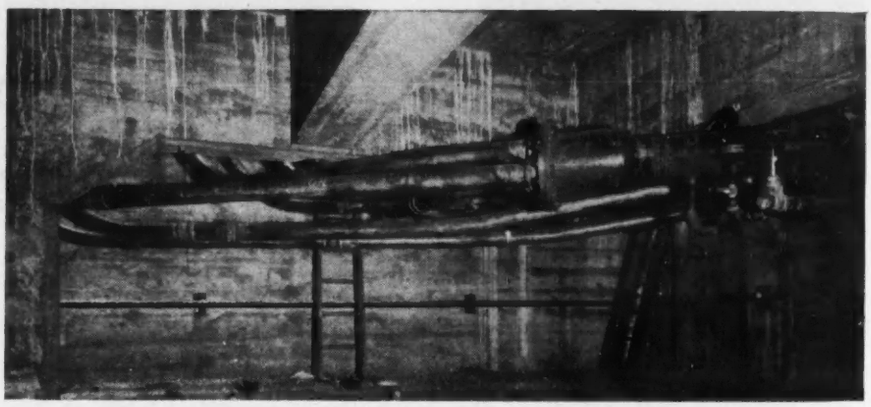


**FIG. 3—Oilostatic runs of generator leads prove flexible manner of dodging obstacles**

Since it was impossible at the time to obtain the steel pipe with upset ends suitable for welding with chill rings, Smith & Dixon flanged joints were used on the generator pipe runs. Moreover, the use of these joints facilitated the installation of pipe in close quarters where welding would have been difficult. All the pipe was prefabricated and the only work done in the field was the bolting together of the various rings.

The Smith & Dixon joints used are similar to the Van Stone joint, the exception being that the faces of the mating surfaces have odd and even numbers of annular serrations which provide a gasketless seal when bolted together. Tests on these joints have been made at 2,700 lb. per square inch with hot, light oil and with the pipe mechanically loaded without any sign of leakage. The serrations on the mating faces do not bottom, the seal provided entirely by side contact.

Potheads are of special construction (Fig. 4), designed to terminate two conductors of the same phase. This pothead consists of a joining bell with the porcelain mounted on the top and is so designed as to withstand a test pressure of 500 lb. per square inch. Oil pressure is imposed to the very top of the bushing. All metal parts of this bushing are bronze and assembly is a simple matter.

All conductor joints and terminal lugs used in this system were mechanically made, using a tubular sleeve compressed radially and shot through with steel pins by a Temple

**FIG. 4—Pothead for terminating 13.8-kv. generator leads brings two cables to single stud** →

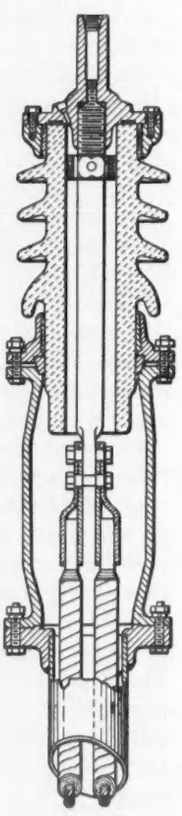
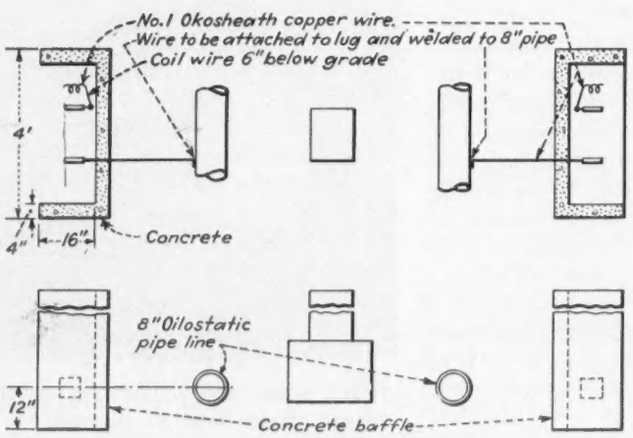


**FIG. 5—Coupons buried alongside 8-inch pipe give clues to incipient electrolysis**



gun to develop about double the strength of soldered joints or about 25,000 lb. pull on test. This method was described in the February 22, 1941, issue of the ELECTRICAL WORLD.

As mentioned above, since the previous article there has been a second installation of two 132-kv. Oilostatic cables to deliver the output of the second 125,000-kw. generator unit to the switchyard. The soil conditions are considered good from the electrolytic standpoint, but every precaution is being taken to prevent deterioration of the pipe. Six-by-six-inch coupons of the same metal as the 8-in. pipe are buried at the same depth and in the same kind of soil. Pairs of coupons are installed in U-shaped concrete inclosures, with the side (Fig. 5) away from the pipe line open to soil currents. These are located at approximately 300-ft. intervals. Each pair consists of one coupon connected to the 8-in. pipe and an electrically isolated coupon connected only to a bare-copper coil lying about 6 in. below ground surface.

Potential measurements for detection of electrolytic conditions can in addition be made at monuments (Fig. 6) which also mark the routes of the pipe lines so that any future excavation operations can be conducted without injury to the pipes or their coatings. Each 8-in. pipe has a No. 1 Okosheath copper wire attached to a lug which is welded to the pipe. These leads are brought up in 2-in. fiber ducts inside the 12-in. square monuments.

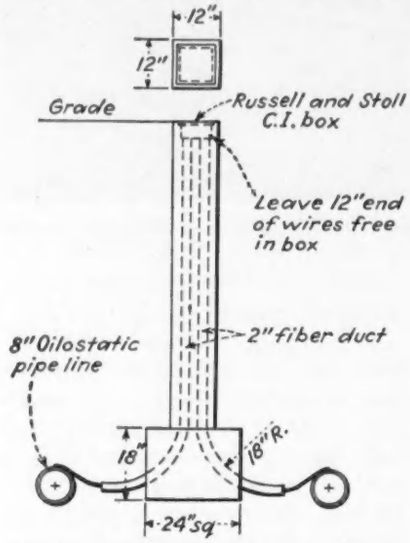



**FIG. 6—Monuments provide means for checking electrolytic potentials**

# Cold Cathode Tubes in Industrial Lighting

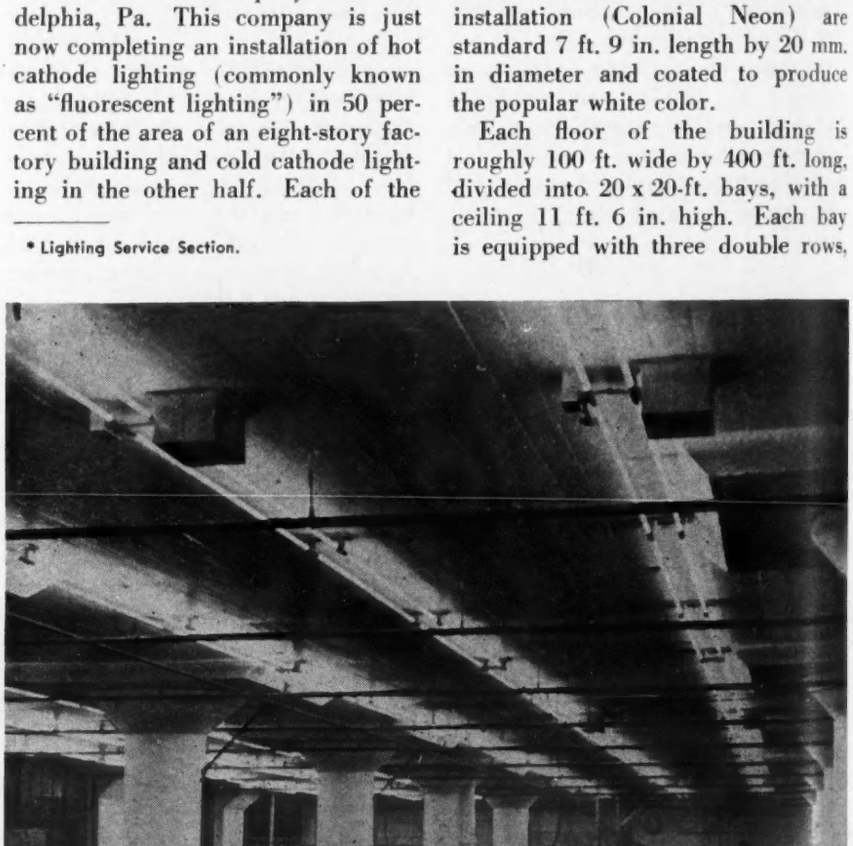
***Using no reflectors, series tubes attached directly to white-painted ceiling — Copper and steel saved by using transformers with 230-volt primaries and without supplementary housing***

***WENDELL PHILLIPS,* Philadelphia Electric Company***

AN OPPORTUNITY to observe the performance characteristics of both hot and cold cathode tube lighting in a major installation under one roof is presented in the plant of the I-T-E Circuit Breaker Company of Philadelphia, Pa. This company is just now completing an installation of hot cathode lighting (commonly known as "fluorescent lighting") in 50 percent of the area of an eight-story factory building and cold cathode lighting in the other half. Each of the two systems is designed to produce an average of 35 foot-candles of general illumination, with local lights added at certain machines where higher levels of illumination are needed. The tubes used in the I-T-E installation (Colonial Neon) are standard 7 ft. 9 in. length by 20 mm. in diameter and coated to produce the popular white color.

Each floor of the building is roughly 100 ft. wide by 400 ft. long, divided into 20 x 20-ft. bays, with a ceiling 11 ft. 6 in. high. Each bay is equipped with three double rows,

* Lighting Service Section.



**THREE double rows of tubes run straight across the ceiling through column bays 20 ft. wide.**

or six tubes, running the length of the building, and mounted directly on the ceiling. The ceiling itself is coated with a white paint having a reflection factor of about 85 percent when new and clean, which is substantially higher than that of the average first-class reflector. This plan of mounting the tubes directly on a ceiling of high reflecting capacity produces a more even illumination across the floor than if they had been mounted in a curved reflector. And, of course, the situation in critical materials made it virtually necessary to devise a reflecting surface other than the usual steel-enamel materials; hence the painted ceiling as a reflector.

Right from the beginning it was necessary to design the entire system to conserve materials and to permit occupancy of the building at the earliest possible date.

### *Transformers*

Three sizes of transformers (Sola) for supplying the tubes are used; twelve tubes are supplied by a 12,000-volt transformer, ten tubes are supplied by a 9,000-volt transformer and eight tubes are used on a 7,500-volt size. The transformers themselves were seized upon as one point where critical materials might be saved in this installation.

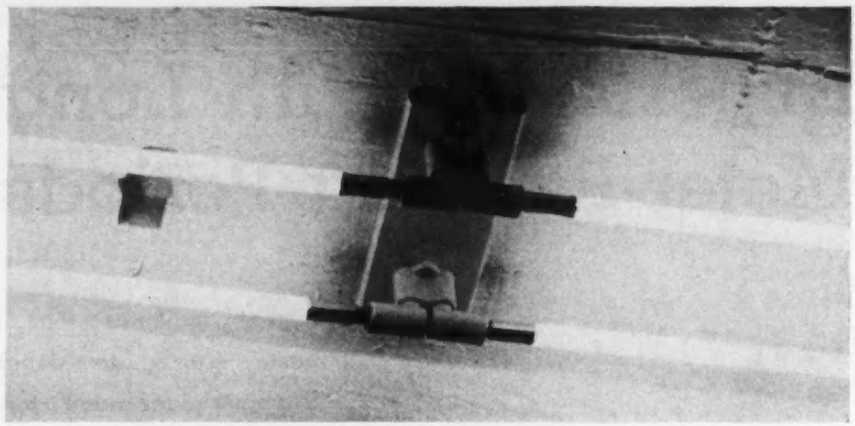
The Underwriters' Laboratories were consulted, and they agreed that the previous method of incasing this type of transformer in an extra metal housing could be dispensed with on this job, since they are already inclosed in an approved case and were to be used on the inside of a building and mounted out of harm's way. The high-power-factor transformers could thus dissipate heat more rapidly and hence lengthen condenser life.

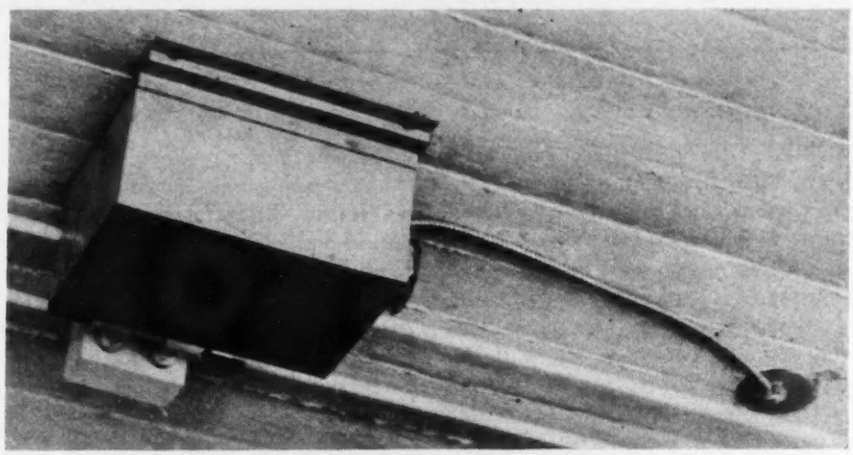
The winding of the primary side of these transformers was established at 230 volts instead of the usual 115 volts, to effect a saving in copper for the step-up to the high-voltage side. A total of 392 transformers are used to supply approximately 4,000 tubes, so that the saving in copper in the transformers was not inconsiderable. Two of the transformers can be seen near the top edge of the accompanying general view.

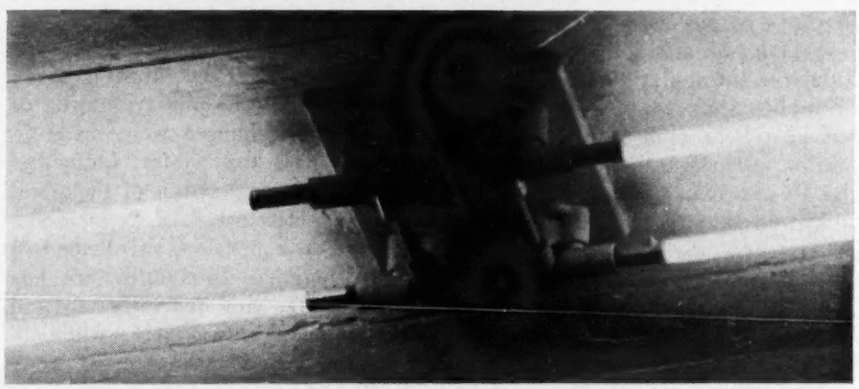
As to operation, current consumption and light output of the system, the Electrical Testing Laboratories report shows that twelve 7-ft. 9-in. tubes, or roughly 93 ft. of tube, consume 629 watts of energy, or 6.6 watts per foot of tube. And the twelve tubes operating on a 12,000-volt, 120-ma. transformer, with actual operating current being 101 ma., produced a total of 24,750 lumens, or 266 lumens per foot. This gives a light output of 40.3 lumens per watt. The I-T-E job had 39 lumens per watt initially.

A typical 20x20-ft. bay equipped with six continuous lines of tube is thus being lighted to an illumination level of 35 foot-candles on an energy consumption of 1.95 watts per square foot of floor area, including transformer losses.

Complete operating data are not available at this early date, but it will be interesting to study such data after a year or two of operation, since this probably is one of the largest industrial applications of cold cathode lighting in the country.







**TRANSFORMER and tube connections. In and out series sockets (top) for holding and connecting tubes. Transformer mounted beside tube run (center); 230-volt primary connection to outlet at right. Sockets turned to 90 deg. for closing loop at end of tube run (bottom)**

# Experience With Longer Meter-Reading Periods

***Survey indicates that the electric industry is making haste slowly in departing from monthly readings—Changes so far made appear to be wartime expedients, mostly***

ALTHOUGH much talk has been heard about lengthening meter reading periods since this country entered the war, the idea is still pretty much in the discussion and experimental stages and is looked upon quite generally as a wartime expedient. This conclusion results from study of 136 responses to a request for information on the subject sent out by ELECTRICAL WORLD to 217 electric utilities. The high ratio of replies to requests, 63 percent, is an indication of great interest in the matter throughout the industry, but analysis of the contents of replies indicates that it probably will be quite a while before all the 32 million electric utility customers in the United States will see the meter reader any less frequently than usual.

### *Majority Report Changes*

Seven of the replies reported that energy was not sold at retail and no meter reading problem was involved. Less than half of the remaining replies, 60, reported no change in meter reading practices. But all of these are not to be counted as wholly negative votes because 13 of them said consideration was being given to the idea or that trying it out was contemplated or planned. And 10 others reported post-card readings for more or less of their rural customers, leaving only 37 uninterested and adhering without change to monthly calls of the meter reader.

However, evidence that the industry is making haste slowly in inaugurating reading period changes appears from the accompanying tabulation of the 69 affirmative replies. Most of the changes apply only to rural customers. In only six instances is the longer period applied to billing as well as to reading. Only six replies say that the change is regarded as permanent, even though but four report increases in delinquent bills and just three note unfavorable customer reaction.

### *Growing Trend*

The earliest change reported was in April, 1942. The latest is given as March, 1943. About two-thirds of the reported changes were made in the past fall and winter, indicating perhaps an acceleration of the trend toward longer intervals.

New reading periods vary from two to six months. Bi-monthly are less favored than are quarterly, 25 and 43 instances respectively, while in four cases intervals are of four months and one is of six months.

In 49 replies it was stated that bills are estimated for months intervening between meter readings. Return postcards on which customers mark positions of meter register hands are used by 17 of the utilities replying. To this number there may be added the ten that were earlier mentioned instances of postcard readings that do not appear in the tabulation. These are of utilities reporting no change in meter-reading practices, but which use the postcard method in rural service, not just for months that intervene between calls of the meter reader, but for all except irregular check-up readings.

Comments on the effectiveness of postcard reading were offered in ten replies. Returns of 95, 92, 90, 85, 85, 83 and 65 percent were reported. In the three other cases, postcard reading was described as "successful," "satisfactory" and "perfect." From this evidence it appears that a sufficient number of customers will mail in postcard readings to make the method entirely practicable, especially in rural areas, where people readily understand the reasons for it.

As stated earlier, it is mostly rural customers that are affected by changes in reading periods. In 50 of the cases tabulated the change is confined to rural service and in 17 urban customers are included. In all cases the figures of customers exclude industrial and commercial consumers of over, say, 3-kw. demand, whose meters continue to be read monthly.

### *Savings Indefinite Yet*

Only 12 of the 69 tabulated replies report that the lengthened reading periods apply to the maximum possible numbers of customers. In six additional instances both rural and urban customers are included, but each group only in part.

Savings accomplished by longer reading intervals appear from the table to be quite definite in the cases where they are given. But too much reliance should not be placed on the figures because they are mostly just estimates. Changes in reading periods are too recent to produce reliable figures. In some replies it was stated that for this reason savings were not

## Analysis of Replies to Meter Reading Survey

| Company | Time of Change | New Reading Period, Months | Bills Estimated, Intervening Months | Post-Card Reading, Intervening Months | No Bills Rendered, Intervening Months | Rural Customers Affected-Percent | Urban Customers Affected-Percent | Percent Savings in Manpower | Percent Savings in Supplies | Percent Savings in Auto Mileage | Customer Reaction | Delinquent Bills | Is Change Permanent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1A | 12/42 | 6 | Y | Y | | 20* | | 84 | | 84 | F | N.I. | N.D. |
| 1B | 6/42 | 3 | | Y | | 50* | | 50 | | 50 | F | N.I. | N.D. |
| 1C | 6/42 | 2U | Y | | | 100 | 100 | 60 | | 65 | D.R. | N.I. | P |
| | | 4R | | | | | | | | | | | |
| 1D | 1/43 | 3 | Y | | | 100 | 100 | | | | F | N.I. | N.D. |
| 1E | 12/42 | 2 | Y | | | | 100 | 33 | 33 | | F | N.I. | N.D. |
| 1F | 10/42 | 2 | Y | | | 100 | 100 | 40 | | | D.R. | N.I. | N.D. |
| 1G | 12/42 | 2U | Y | | | 100 | 100 | 30 | | 50 | F | N.I. | N |
| | | 3R | | | | | | | | | | | |
| 1H | 8/42 | 2 | Y | | | 100 | 100 | 50 | | 50 | F | D | P |
| 1I | 1/43 | 2 | | | Y | | | | | | | | |
| 1J | 9/42 | 3 | Y | | | 30 | 4 | 25 | | 60 | F | N.I. | P |
| 1K | 9/42 | 2 | Y | | | 42 | 42 | | | 38 | F | I | N.D. |
| 1L | 9/42 | 2 | Y | | | 40 | 15 | 10 | | 50 | F | | N.D. |
| 1M | 1/43 | 2 | Y | | | 100 | 100 | | | 30 | F | | N |
| 1N | 7/42 | 2 | | | Y | 100 | | | | 50 | F | N.I. | N |
| 1O | 1/43 | 3 | Y | | | 13* | | | | 60 | F | | N |
| 1P | 5/42 | 3 | Y | | | 90 | | | | | F | N.I. | N.D. |
| 1Q | 12/42 | 3 | Y | | | 2* | | | | | N.F. | N.I. | N.D. |
| 1R | 6/42 | 3 | Y | | | 100 | | | | 65 | F | N.I. | N.D. |
| 1S | 8/42 | 3 | Y | | | 100 | | 10 | | 50 | F | | P |
| 1T | 8/42 | 3 | Y | | | 100 | | | | 67 | F | N.I. | N |
| 1U | 1/43 | 3 | Y | | | 100 | | | | 67 | F | N.I. | N.D. |
| 1V | 9/42 | 3 | Y | | | 13 | | | | 67 | F | N.I. | N |
| 1W | 10/42 | 2 | Y | | | | | 50 | | 50 | F | N.I. | N.D. |
| 1X | 12/42 | 2 | Y | | | 100 | | | | | F | | |
| 1Y | 4/42 | 2 | Y | | | 85 | | | | 40 | F | I | N |
| 1Z | 2/43 | 4 | Y | | | 100 | | | | 35 | | | N.D. |
| 2A | 7/42 | 3 | | Y | | 40* | | | | 50 | F | N.I. | N |
| 2B | 7/42 | 2 | | | Y | 100 | | 45 | 45 | 50 | F | N.I. | N.D. |
| 2C | 10/42 | 3 | | Y | | | | 2 | | 22 | F | N.I. | N.D. |
| 2D | 10/42 | 4 | | Y | | 15* | | | | 20 | F | N.I. | N.D. |
| 2E | 9/42 | 3 | | Y | | 100 | | | | | F | N.I. | N.D. |
| 2F | 3/43 | 2 | | | Y | | | | | | | | |
| 2G | 7/42 | 3 | Y | | | 19* | | 50 | | 50 | F | I | N.D. |
| 2H | 4/42 | 3 | | Y | | 100 | | 7 | | 57 | D.R. | | N |
| 2I | 10/42 | 3 | Y | | | 100 | | | | | F | I | N |
| 2J | 2/43 | 3 | | Y | | 30* | | | | | F | | N.D. |
| 2K | 8/42 | 3 | Y | | | | | 50 | | 60 | F | N.I. | N.D. |
| 2L | 10/42 | 2 | | | Y | 100 | | | | | | | N.D. |
| 2M | 12/42 | 3 | | Y | | 20* | | | | 40 | F | N.I. | N.D. |
| 2N | 11/42 | 3 | Y | | | 100 | | 15 | | | F | N.I. | N.D. |
| 2O | | 4 | | Y | | 100 | | | | | | | |
| 2P | 6/42 | 2 | Y | | | 100 | 100 | 37 | | 40 | F | N.I. | N.D. |
| 2Q | 8/42 | 2 | Y | | | 70* | | 29 | | 60 | F | N.I. | P |
| 2R | 9/42 | 2 | Y | Y | | 10* | 13* | 25 | | 50 | F | N.I. | N |
| 2S | 3/43 | 2 | | | Y | 8* | | 15 | 25 | 40 | | | N.D. |
| 2T | 9/42 | 3 | Y | | | 100 | | | | 55 | F | N.I. | N.D. |
| 2U | 11/42 | 2 | Y | | | 80* | | 20 | | 30 | F | N.I. | N.D. |
| 2V | 11/42 | 3 | Y | | | 7* | | | | 67 | N.F. | | N.D. |
| 2W | 11/42 | 3 | | Y | | 90 | | | | 50 | F | N.I. | N.D. |
| 2X | 7/42 | 3 | Y | | | 100 | 1 | 10 | | 57 | F | N.I. | N.D. |
| 2Y | 9/42 | 3 | Y | | | 100 | 10 | 10 | 10 | 50 | F | N.I. | N.D. |
| 2Z | 6/42 | 2U | Y | | | 100 | 100 | 50 | | 48 | F | N.I. | N.D. |
| | | 3R | | | | | | | | | | | |
| 3A | 9/42 | 3 | Y | | | 94* | | 11 | | 50 | F | N.I. | N.D. |
| 3B | 4/42 | 3 | Y | | | | | | | 55 | N.F. | N.I. | N.D. |
| 3C | 1/43 | 3 | Y | | | 25 | | | | | | | N.D. |
| 3D | 1/43 | 2 | Y | | | 100 | 100 | 42 | | 40 | F | | N.D. |
| 3E | 7/42 | 3 | | Y | | 12* | | | | 25 | F | N.I. | N.D. |
| 3F | 7/42 | 3 | Y | | | 95* | | 49 | | 30 | F | N.I. | N.D. |
| 3G | 1/43 | 3 | Y | | | 100 | | | | | F | N.I. | N.D. |
| 3H | 10/42 | 3† | | Y | | 20* | | | | 63 | F | N.I. | N.D. |
| 3I | | 3 | | Y | | 4* | | | | | F | N.I. | N.D. |
| 3J | 11/42 | 3 | Y | | | 25* | | 12 | | 30 | | | N.D. |
| 3K | 6/42 | 2 | Y | | | 8* | | 7 | | 50 | F | N.I. | N.D. |
| | 1/43 | 3 | | | | | | | | | | | |
| 3L | 10/42 | 2 | Y | | | | 100 | 42 | | 50 | F | N.I. | N.D. |
| 3M | 2/42 | 3 | Y | | | 100 | | 30 | | 30 | F | N.I. | |
| 3N | 3/43 | 2 | Y | | | 100 | 100 | | | | F | | N |
| | | 3 | | | | | | | | | | | |
| 3O | 10/42 | 3 | | Y | | 16* | | 22 | | 22 | F | N.I. | N |
| 3P | 1/43 | 3 | Y | | | 100 | | 50 | | 66 | F | N.I. | N.D. |
| 3Q | 6/42 | 3 | Y | Y | | 2* | | | | | F | N.I. | P |

* These percentages are of total numbers of customers, not of rural customers only. † No regular quarterly readings, but only if post cards are not returned for three consecutive months. U — Urban. R — Rural. Y — Yes. F — Favorable. D.R. — Divided Reaction. N.F. — Not favorable. N.I. — No increase. I — Increase. D — Decrease. P — Permanent. N — No. N.D. — No decision.

yet known. When the intervening months are billed on estimated energy consumptions or on postcard readings such savings as are realized can be only in meter reading. And those savings may be absorbed in more or less degree by added complications in billing and collecting. Also, in rural service, lengthening the meter-reading period may result in no saving in manpower at all except as the employee or employees concerned may have additional time for other duties.

However, there is one saving that is really important in these days when gasoline, tires and motor vehicles must be jealously conserved. This is in auto mileage. Many of the replies pointed out that anticipated reductions in auto mileage was the principal reason for extending time between meter readings.

### *Reaction Mostly Favorable*

Customer reactions, as well as they can be determined in the thus-far short experience, are generally considered to be favorable. Only three replies said customers did not like the change, and three reported that reaction was divided.

Experience is probably too short also to justify any really valid conclusion on whether or not longer reading periods affect the number of delinquent bills. No increase is reported in 43 replies, increases are reported by four and one says there is a decrease.

The real indication of how utilities are looking at the idea of longer intervals between meter readings is furnished by the last column of the table. Of the 64 utilities that replied to the question, "Is the change expected to be permanent?" only six answered "Yes," 13 said "No" and 45 reported that they were undecided. It is quite apparent from these proportions of replies that lengthening of reading periods has not yet gained much acceptance as a practice for normal peacetime operation, but is regarded rather as a wartime expedient useful in helping to close ranks after losses in manpower and to conserve equipment not easily replaceable.

However, judging by replies from companies that have, so to speak, "gone the whole hog," and by the 25-year experience of the Detroit Edison Company, which was reported in ELECTRICAL WORLD, February 20,

1943, it is possible for utilities to read meters and render bills at longer than monthly intervals and thus to accomplish significant economy without arousing unfavorable customer reaction.

Support for this conclusion is to be found in the quotations from letters which, under the heading of "Pros and Cons," conclude this article. These quotations indicate that lack of enthusiasm for extended reading periods is largely a matter of preconceived opinion and that enthusiasm for it rests upon experience with it. Apparently the old olive parallel applies here; you've got to eat 'em to develop a taste for 'em.

## Pros and Cons

**"We have inaugurated a plan of reading rural customers' meters every three months. We do not estimate the monthly bills, but instead use a meter reading postcard which is mailed to the customer every month a few days before the regular reading date. We have had a very fine acceptance from our rural customers and have attained nearly 100 percent response. When the plan was inaugurated we sent a letter of notification to customers calling attention to the great need for conserving transportation and asking their co-operation as a civilian defense measure. Estimates indicate a reduction in transportation of 7,000 miles per month and a saving in expense of approximately $500 per month."**

**"No increase in delinquent bills; as a matter of fact, a decrease. We plan to continue bi-monthly readings and are thinking of going to quarterly readings."**

**"In July, 1942, we adopted a plan of bi-monthly reading and billing for our rural areas. This covered about 40 percent of our customers. The acceptance then and since has been most gratifying. We have received almost no complaints and the demand for adjustments has been less than one-tenth of 1 percent. We believe the success of the plan was due largely to the general expectation of the public that all people should make reasonable effort to make savings of vital war equipment and our explanation of the proposal before it was put into effect. We were very careful to see that each customer received a letter from the president and also a personal explanation by the meter reader the previous month. It is difficult to ascertain the exact percent of saving as the same men read both rural and urban areas. The bi-monthly routes were arranged so that the men who now read the meters have a full month's work each month. There were substantial savings in manpower, transportation and office detail at a time when every effort should be made to secure such savings. We anticipate changing to bi-monthly reading and billing in our urban areas as the difficulties of securing efficient and reliable readers increase."**

**"Personally I am now convinced that no serious difficulties will be encountered and we probably will have the majority of our residential and commercial consumers on two-month reading before the end of 1943."**

**"We hope to retain the plan as a permanent method. We are satisfied that it is acceptable for all-around operation."**

**"In operating under the 'estimated billing' plan with meter readings at extended intervals we have found considerable difficulty in answering customers' complaints and inquiries regarding the plan, particularly where the estimated and actual usages differed considerably and adjustments were necessary in prior billing when an actual meter reading was obtained. In spite of these difficulties we believe that the idea of extending the interval between meter readings is fundamentally sound, since it reduces the time and expense consumed in operation, which adds nothing whatever to the value of usefulness of our service to the customers. If the mechanics of billing under the plan for reading meters at extended intervals can be perfected and the customer educated to accept the practice as a matter of course, I believe we will never return to the wasteful practice of reading meters at monthly intervals and will realize a permanent economy in the operation of our business."**

**"We are still reading monthly. Will not change until forced to do so, as we foresee a definite reaction of customers against a change."**

**"We are continuing our billing on a monthly basis because most people budget their accounts on a weekly or monthly basis."**

**"We have given some consideration to changing to a bi-monthly basis, but, as yet, the liabilities still outweigh the assets. In other words, some additional factors other than now present will have to enter the picture before we can change our present policy."**

**"We have considered the possibility of lengthening meter reading periods, but have decided to continue reading on a monthly basis. In our particular case we have a large influx of defense workers and service men who move frequently, so that we feel any saving made in lengthening the period would be more than offset by the revenue lost from transients."**

**"It is our opinion that the average electric customer is inclined to be unduly critical of his bill for service and that he gives very little consideration to the period covered by the bill. We are, therefore, desirous of rendering him the statements covering no more than 30 days' service, if that is possible."**

**"We are of the opinion that any attempt made to estimate bills will lead to bad consumer reaction, and think that it is the best policy to continue as far as possible the practice in the past, provided it can be done without using personnel normally subject to war efforts."**

**"Although the plan of bi-monthly billing indicates large savings, it is our opinion that monthly bills would be received more favorably by our customers."**

**"Our chief difficulty is obtaining regular readings due to the number of people now working in industry. Also, adjusting errors in estimates due to unknown factors affecting consumption."**

**"Quarterly reading in our experience has proved an unsatisfactory, but necessary, makeshift, inasmuch as demand power readings *must* be made monthly anyhow and the reading of meters is only one of the duties of the meter reader as he makes his rounds. Our quarterly reading is restricted to rural areas, which have a fairly stable population and hence the failure to arrive monthly of a personal contact representative of the company who answers questions, checks meter connections, and accepts payment as accommodation, has less effect than in congested districts subject to more customer turnover."**

**"Considerable increase in number of allowances resulting from estimating bills too high—mostly when people are away from home."**

# Chemical Background for Electrical Properties of Plastics

***Particular manner in which elements combine and polymerize into chains and networks tends to establish the electrical properties as well as the non-electrical***

*H. M. RICHARDSON, Engineer, Plastics Department, General Electric Company*

PLASTICS in general are made up of relatively simple participations of a limited number of chemical elements. Chemically, however, the structures on which their properties depend are relatively complicated chains and networks into which these monomers can be polymerized.

Electrical engineers can get some grasp of the origin of the otherwise confusing array of tabulated values of dielectric loss, dielectric strength, arc resistance, moisture absorption, etc., by viewing the rudiments of plastic chemistry.

To a considerable extent the element which happens to serve as the connecting link in the formation of the chains seems to determine the stability of the material. As an example, the phenol-base plastics have relatively poor arc resistance because the carbon, exposed when high heat occasions instability, provides a carbonized surface for arc track. As knowledge of plastics increases and becomes better correlated it is likely that other characteristics will be associated with the particular links that break when instability follows external influences.

### *Two Groups*

Plastics are classified in two principal groups, thermoplastic and thermosetting. The thermoplastic soften again on subsequent application of heat; the thermo-setting plastics do not. The thermoplastics are straight-chain polymers, the thermo-setting varieties have long chains cross-linked by means of an added reactive material to form "three-dimensional" networks. In general, the straight-chain hydrocarbon thermoplastics have good electrical properties.

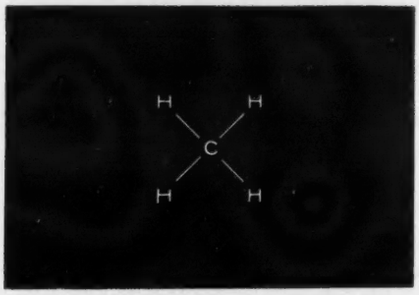



**FIG. 1—Methane is carbon (valence = 4) united with four hydrogen (valence = 1) atoms**

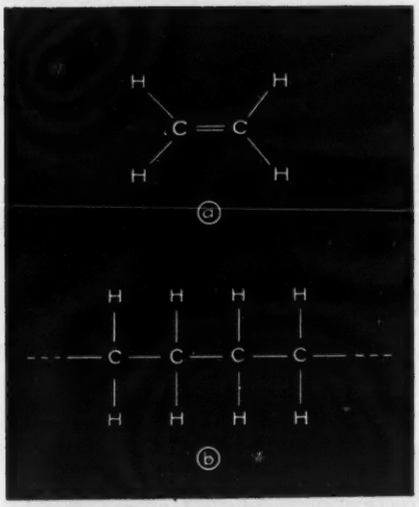



**FIG. 2—Ethylene (a), a gas, can be polymerized into polyethylene (b), an elastic solid with very low dielectric loss at high frequency**

Many plastics are made up only of carbon and hydrogen put together in various ways; others contain carbon, hydrogen and oxygen; others contain carbon, hydrogen and chlorine; others carbon, hydrogen and nitrogen, and still others carbon, hydrogen, nitrogen and oxygen.

First, assume only two elements, carbon and hydrogen. Carbon has a valence of four. In other words, the carbon atom is capable of joining to other atoms at four points. Hydrogen has a valence of but one. A common example of a combination of carbon and hydrogen is natural gas, which is mostly methane, consisting of molecules made up of one carbon atom and four hydrogen atoms (Fig. 1).

### *A Polymer*

Another gaseous material is ethylene, which is the product of the high-temperature cracking of petroleum. Here we have two carbon atoms joined together by what is called a double bond (Fig. 2a). In other words, two valences of each carbon are joined together. The other two on each carbon are attached each to a hydrogen. If ethylene is subjected to the proper influence, such as high pressure and temperature, and the right type of catalyst is present to initiate the reaction, the result is called a polymer. In other words, the double bond between the carbons in the ethylene molecules opens up and these "hands" thus freed grasp the free "hand" of the next molecule, and so on, forming a chain (Fig. 2b).

The former gas is thus converted to a solid with a softening point of about 75 to 80 deg. C., which when melted and molded has considerable toughness and structural strength, although it is quite elastic. One of its principal virtues is that it is an excellent electrical insulating material having extremely low dielectric losses at high frequencies. For example, the power factor is 0.0002 to 0.0005 and the dielectric constant is 2.3. With these properties its principal use has been, so far, in the insulation of cables conducting ultra-high-frequency currents.

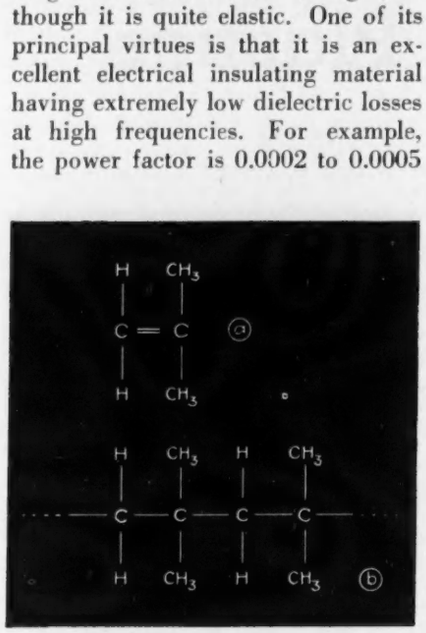


FIG. 3—Polyisobutylene (b), called Vistanex, is a chain based on isobutylene (a) and is a low-melting-point thermoplastic with excellent electrical characteristics

### *Isobutylene*

Another by-product of the cracking of petroleum is isobutylene, which has two carbon atoms joined together by a double bond and to one of these two hydrogens (Fig. 3a). To the other we have two additional carbon atoms, to which in turn are joined three hydrogens each.

Under the proper influence the double bond will still open up (Fig. 3b) and result in a tough, rubber-like solid. Unlike rubber, however, this polyisobutylene, or "Vistanex" as it is called, cannot be vulcanized by sulphur, since there are no remaining double bonds or points of reaction to which sulphur can attach itself. "Vistanex" is, therefore, a thermoplastic material. It also has excellent electrical characteristics, power factor and low dielectric constant. However, it is quite soft and has a relatively low melting point, so its structural properties are not particularly good and its use is limited to insulations where it can properly be confined or where it can be mixed with other plastic materials giving certain desirable properties.

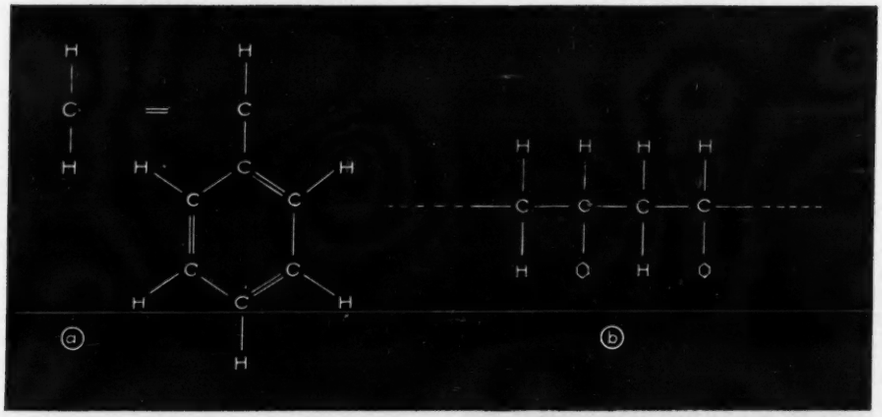


FIG. 4—Polystyrene (b) is a chain of styrene (a) structures which has low loss and power factor. The lozenge in (b) represents the $C_6H_5$ ring of (a)

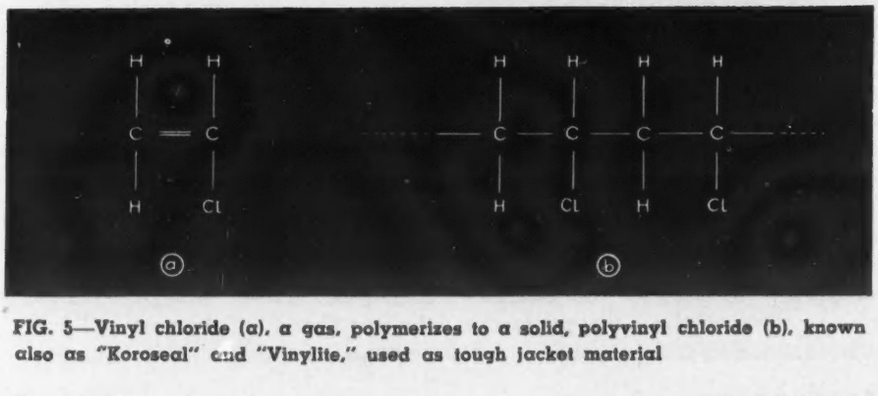


FIG. 5—Vinyl chloride (a), a gas, polymerizes to a solid, polyvinyl chloride (b), known also as "Koroseal" and "Vinylite," used as tough jacket material

### *Styrene*

Styrene is a bit more complicated, although it is built around the same type of structure (Fig. 4a). Two carbon atoms are joined together by a double band and to one of these the hydrogen atoms. To the other we have one hydrogen atom and a group consisting of six carbon atoms and five hydrogen atoms joined together in a ring.

This also will, under the proper conditions, polymerize so that many of these styrene molecules will join together in the form of a long chain, polystyrene (Fig. 4b), which is a material with much better structural properties than either the polyethylene or the Vistanex. Styrene is very hard and rigid, begins to soften at about 75 to 80 deg. C., can be readily molded into all manner of molded articles, has a power factor of about 0.0002 and a dielectric constant of about 2.4. Here again the fact that this material is made up only of carbon and hydrogen is responsible for its very low dielectric losses. It is also extremely resistant to moisture absorption.

Polystyrene is already quite commonly used for high-frequency electrical insulation where the temperature of operation is not too high.

Styrene is also one of the ingredients used in the manufacture of some of the new synthetic rubber-like materials. It is produced synthetically, starting with benzene and ethylene, or is separated from the other ingredients of drip oil which is a by-product of the manufacture of carburetted water gas. The necessarily large increase in the production of synthetic rubber in this country will mean that styrene must be produced in very large quantities. Consequently, it is reasonable to expect that polystyrene will be one of the commonest of the plastic materials to be used in the future.

### *Polyvinyl Chloride*

Another similar material, vinyl chloride, is made up of carbon, hydrogen and chlorine. Two carbon atoms are joined together (Fig. 5a)

by double bonds, one carbon having in addition two hydrogen and the other having one hydrogen and one chlorine attached, since chlorine, like hydrogen, has a valance of one. This material is a gas at ordinary temperatures, but likewise can be polymerized to a solid to form a long chain polymer very similar to the polyethylene, with the only exception that each alternate carbon atom has a chlorine attached to it in place of a hydrogen atom.

This is called polyvinyl-chloride (Fig. 5b), which is being manufactured in this country in very large quantities and sold under the trade names of "Koroseal" and "Vinylite." It is not used directly as a plastic, but is mixed with what is called a plasticizer—in this case a material in which the polyvinyl-chloride can be dissolved and yet one which has a very high boiling point so that it will not be lost by evaporation at ordinary temperatures. Vinyl chloride is made from very abundant and inexpensive materials, being the direct reaction product of acetylene and hydrogen chloride, and is potentially very low in cost. At present practically the entire output of polyvinyl-chloride is being used for national defense application and for insulation on low-voltage conductors or as tough jacket material for cable and many non-electrical uses as extruded flexible material. It is flame-proof; the presence of chlorine keeps the material from continuing to burn after it has been heated to its ignition point.

### *Vinylidene Chloride*

Vinylidene chloride has two carbon atoms joined together by double bonds; one carbon atom has attached two hydrogen atoms, the other has two chlorine atoms. The polymerized form is sold under the trade name of "Saran," which consists of a small portion of vinyl chloride and a large portion of vinylidene chloride. Both vinyl chloride and vinylidene chloride are very resistant to the penetration of moisture. Neither one is particularly good in so far as dielectric losses are concerned. Consequently, they are not used for high-voltage or high-frequency insulation, although they are entirely satisfactory for low-voltage insulation where the quality of flame-proofness is desirable.

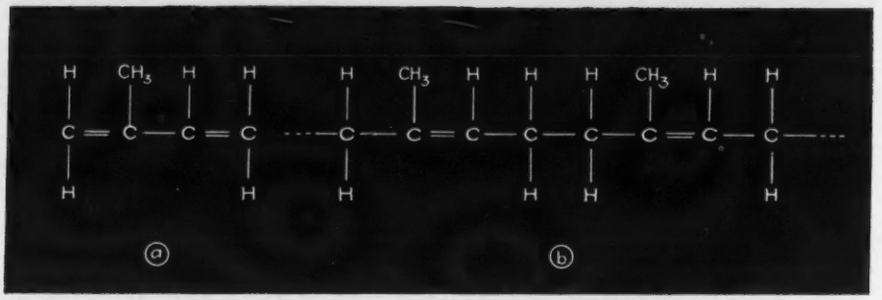


FIG. 6—The repeating element in natural rubber (b) is isoprene (a)

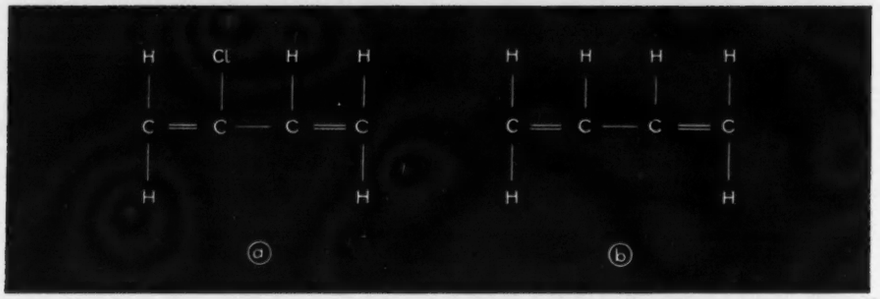


FIG. 7—Chloroprene (a) resembles isoprene (Fig. 6a), but has chlorine in place of $CH_3$; buna is a polymer of butadiene (b), one of the double links serving as the chain-bond and the sulphur of vulcanization providing the complex cross bonds

Another plastic raw material is vinyl acetate; two carbon atoms are joined together by a double bond, one has attached also two hydrogens and the other one has one hydrogen and a group consisting of oxygen, carbon, oxygen, carbon and three hydrogens. It has a low softening point and not particularly good strength. Polyvinyl acetate can be converted to a material known as polyvinyl alcohol, a resinous substance soluble in water, but insoluble in petroleum hydrocarbons and, as such, a grease-proofing agent.

### *Thermosetting Plastics*

Polymers in long chains are occasionally cross-linked by means of another reactive material to make a network giving a thermo-setting material which does not flow readily under heat after the cross linking has been effected. A good example of this class of plastic is the series of vulcanizing synthetic-rubber plastics. It has been known for a long time that the repeating element in natural rubber (Fig. 6b) is a substance known as isoprene (Fig. 6a). If this material is in the form of a polymer it is a thermoplastic material before vulcanizing, but after vulcanizing becomes thermoset as a result of the reaction of sulphur, which has a valance of 2, 4, 6 or 8 with the rubber combining

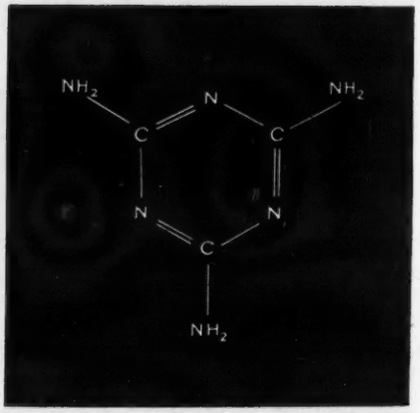


FIG. 8—Melamine embraces nitrogen and offers much more resistance to arcs than phenolic resins

at the double bonds to cross link the long chain molecules. After many attempts to make synthetic rubber, Chloroprene (Fig. 7a) was developed into a synthetic rubber known as Neoprene. The only difference between it and isoprene is that a chlorine atom replaces the $CH_3$ of isoprene. Vulcanized Neoprene has many of the characteristics of natural rubber but, in addition, is considerably more resistant to the action of fats and oils and is not deteriorated as readily by sunlight.

Another synthetic rubber is Buna, a polymer of butadiene (Fig. 7b),

which is a thermoplastic derivative of petroleum gases and has the double bond structure to facilitate cross-linking by sulphur in the vulcanization process. Its tire wear properties are bettered in Buna-S, a copolymer of about three parts of butadiene and one part of styrene. It has better electrical properties than Buna-N (in which a similar quantity of acrylonitrate replaces the stryene, but the latter has better resistance to oil, solvents and heat.

### *Other Cross Links*

Other materials than sulphur are available to use in very small amounts in copolymers with the materials previously mentioned. They generally have two sets of double bonds, both of which open up to join with the other monomeric material during polymerization. They act as cross links in such polymers, making the final material a network or jell, which can be softened and deformed by heating, but will not melt and flow. When the deforming force is removed they will slowly return to their original shape without any appreciable permanent set. So far there has not been any wide use of these in the electrical industries, although some use might be made of a copolymer of styrene with one of these materials such as glycol-dimethacrylate. The mixture of styrene and the cross-linking material can be polymerized into the form of a solid casting which retains practically intact the excellent high-frequency insulating properties of polystyrene, but has the advantage that it is infusible and retains its shape and most of its strength at temperatures around 80 deg. C. Other materials utilizing this same general cross-linking principle are under development which will result in considerable improvement in electrical insulations.

### *Formaldehyde Thermosets*

Other materials which form these dimensional or network polymers are the well-known thermosetting plastics based on phenol-formaldehyde, urea-formaldehyde or melamine-formaldehyde resins. These are all condensation products in which the phenol, urea or melamine is reacted with formaldehyde to form a resin; a by-product, water, called water of condensation, is removed. Units of formaldehyde act as connecting links between the units of phenol, resulting in long chain molecules which are thermoplastic. But phenol has not two, but three, points of reaction, so that additional cross-linking units can be added which will cause the thermoplastic long-chain molecules to become cross-linked and thus make them infusible and insoluble. The thermoplastic resins mixed with the fillers and hexamethylene-tetramine $(CH_2)_6N_4$ which breaks down and the component parts react with the remaining active positions on the phenol units to cross-link them.

### *Form Amine Compounds*

Some of the hydrogens displaced from the phenol combine with the nitrogen of the hexa to form ammonia and with other stray molecules to form various amine compounds. Molded products made with a phenolic resin of this type are good insulating materials. Modifications can be had in various phenolic molding compounds by the variation of the type of filler which is used. For example, asbestos for better heat resistance, mica for lower dielectric losses, fibrous materials such as cotton flock or chopped fabric for increased impact strength, and woodflour, of course, for general-purpose moldings required the best flow and most intricate designs. Another way of reacting phenol-formaldehyde together is to combine a ratio of somewhat more than fifteen units of formaldehyde to ten units of phenol in the presence of an alkaline catalyst like sodium hydroxide or sodium carbonate. The first reaction product is called phenol alcohol, which is soluble in water and as such can be used for impregnation of wood and other fibrous materials. Further heating of this material causes the various units to join together, liberating water and forming a resin which is cross-linked and no longer soluble nor fusible. Materials of this sort can be used for making molding compounds or for binders in the manufacture of laminated products, but owing to the liberation of water, are somewhat lower in their dielectric strength than the ones which do not liberate water during the curing cycle. Phenolic resin solutions are made in other ways to produce laminated products with high dielectric strength or other properties.

### *Melamine Resins*

Melamine resins, a condensation product, give translucency and color stability of the urea formaldehyde plastics, but appears to have the water resistance and heat resistance of the phenolics. Melamine can be used alone or in combination with urea-formaldehyde to make molded products. As an electrical insulating material it has one advantage over the phenolic resins; namely, its arc resistance. Melamine resins are far more arc resistant than phenolic resins. The standard resistance test shows phenolic compounds to break down in a few seconds and "track" while melamine resin compounds will withstand the test for about 200 seconds.

Of course, it is well to remember that all plastic materials are organic materials and as such will be broken down and burned by an electric power arc. They are not in the same class in this respect as the inorganic materials such as porcelain, mycalex or cement-asbestos cold-molded plastics.

Polyvinyl alcohol can be reacted with formaldehyde in such a way that portions of the chains are bridged over and occasionally cross-linked and water of condensation is split off. The result of this reaction is greatly to improve the toughness, raise the softening point and increase the solvent resistance so that we now have a plastic which is technically known as a polyvinyl-acetal and is sold under the trade name "Formvar." It is still a thermoplastic material. The principal use of this material is in the manufacture of a phenomenally tough coating for magnet wire.

### *Plastic Horizon*

As to the newer materials, polyethylene will find uses parallel to those of polystyrene. The new synthetic rubber-like materials will replace natural rubber where better electrical properties and increased resistance to solvents and aging are required. There is a possibility that melamine resin compounds will be used where superior arc resistance is required in an organic plastic and possibly Nylon may find use as a wire insulation due to its high softening point and its excellent strength and toughness.

# Line Relayed to Adjust Local Stations to Local Loads

*Inertia relays in conjunction with high-speed reclosing breakers compensate for omission of ground wires — Transferred ground wires used as armor-rodded conductors — Spliced-pole river towers — No accidents*

*J. F. PENNINGTON* and J. T. LOGAN,† Georgia Power Company, Atlanta*

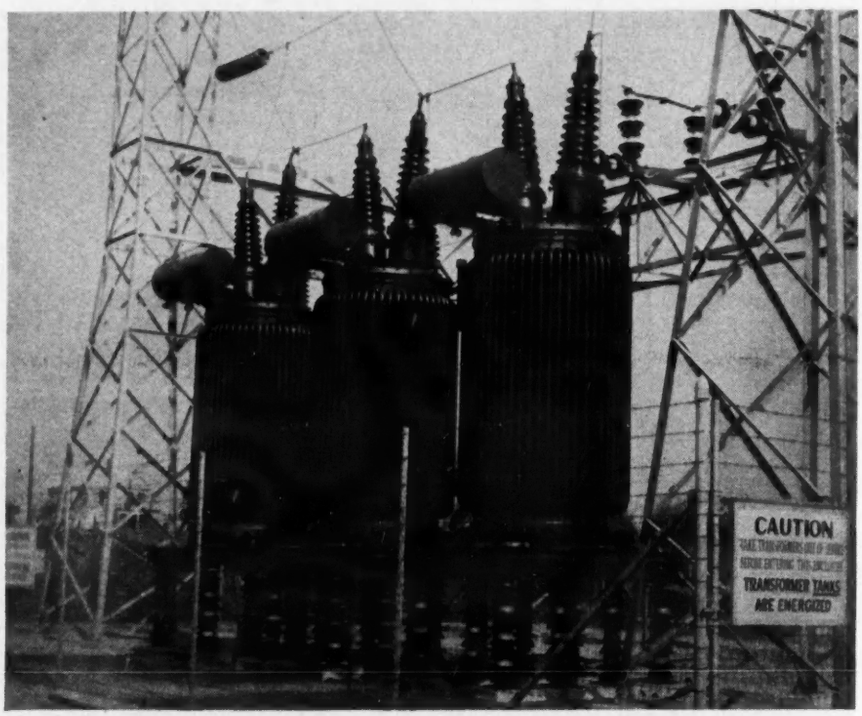
BRUNSWICK and neighboring coastal cities in southeast Georgia were, prior to November 5, 1942, served electric current from four small local generating plants, a large part of the 6,000-kw., 11-kv. system demand being supplied from industrial plants generating excess electric energy as a by-product. Two of the plants, owned by Georgia Power Company, and the others belonging to industries have been operated interconnected through the 11-kv. distribution system for many years.

This isolated distribution system of Georgia Power Company prior to November 5 was located 100 miles from the nearest high-voltage power source on the integrated system, and saving in energy cost on the main system over the cost of generating it locally had not been enough to pay operating costs and carrying charges on an interconnection.

Power requirements for new war production in the territory were estimated to be 6,000 kw., which, with the present load, should create a demand in the area in 1943, exclusive of industries generating their own requirements, of about 12,000 kw. This would be considerably in excess of local generating capacity.

### *WPB Approves Transmission Line*

Scarcity of critical materials was the controlling factor in determining how the war load would be served. The War Production Board hesitated to approve the line because of the enormous amount of critical materials required, and for a time it appeared that the Brunswick area was scheduled for another small high-cost generating plant located at the war production plant.




**ONE OR TWO spliced-pole H-frame structures, 99 ft. high, for crossing Altamaha River; span is 1,053 ft.**

The element of time and over-all economy favored construction of a 110-kv. line, provided some way could be found to avoid going into the market for large quantities of new, critical materials. Finally, one of our engineers suggested the possibility of using for the power conductors some special composite wire then in use as overhead ground wires on a tie line with the Alabama Power Company. A check on the characteristics of this conductor showed:

4 steel strands, size 0.49 in.
3 aluminum strands, size 0.49 in.
Equivalent conductivity, No. 3 cu.
R and X at 50 amp. $1.16 + j.967$
Size No. 2/0.

Calculations indicated that this conductor should be able to deliver 12,000 to 15,000 kw. at Brunswick by boosting the voltage approximately 14 percent at the source (Vidalia).

*Superintendent wholesale operations. †Operating engineer.

Satisfactory boost could be provided by installing three 667-kva., 110/11-kv. transformers, which were shortly to become available from the company's system. On this basis, and with the understanding that all line and substation structures would be made of wood, and that generally an absolute minimum of critical materials would be used, WPB gave approval.

### *Plank-Arm H-Frame*

The line is of the conventional wood-pole, H-frame, plank-arm construction, without overhead ground wires or counterpoise system, using seven insulator units in suspension and nine in strain.

One large river crossing required construction of special wood-pole towers instead of the steel towers which would normally have been used. This was done by splicing together three 70-ft. poles for each side of the structure. Because of the difficulty in replacing these structures, overhead ground wires were installed over the river crossing and the adjacent spans.

Actual construction work was started July 17 and the line and substation were placed in operation November 5. A very substantial part of the line was built through swampy territory and right-of-way clearing was a major job.

Engineering and construction for the project were handled by company forces, and the entire project, including right-of-way clearing and construction of a four-mile, 44-kv. tap line to the war plant, has been handled without a single lost-time accident. Considering the fact that construction was carried on under extreme pressure, and that a large portion of the construction forces were new and inexperienced, this safety record is exceptionally good.

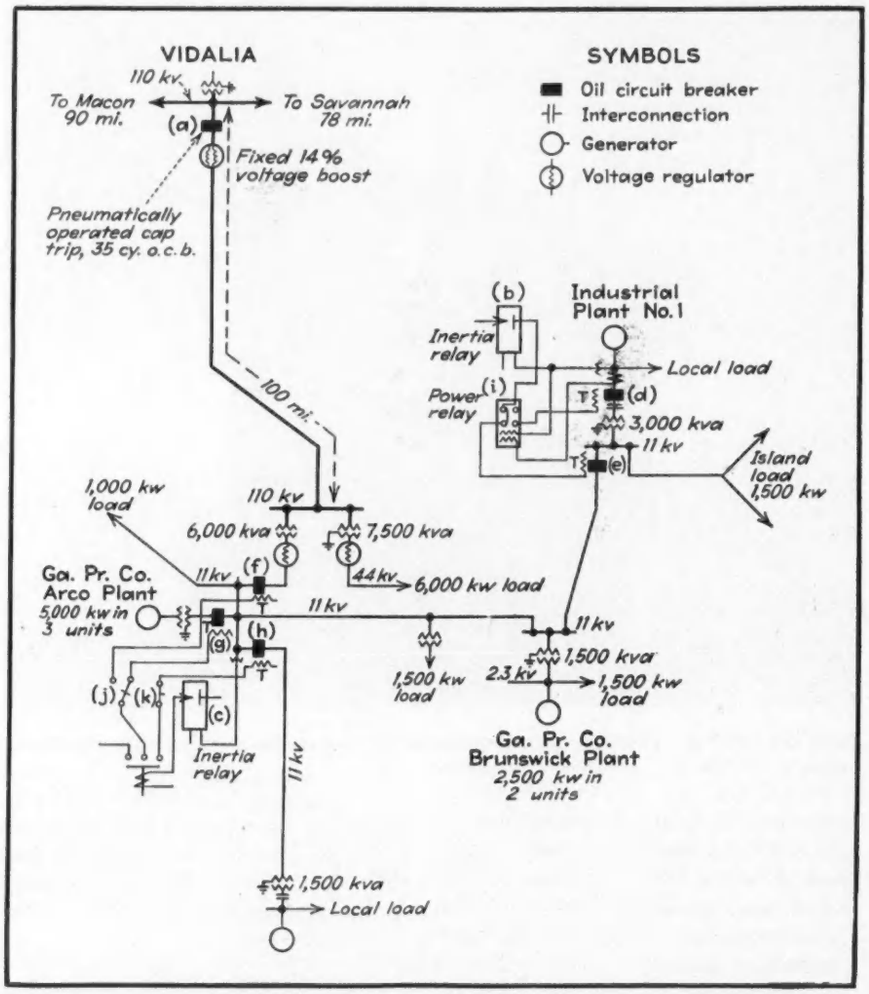
### *High-Speed Switching Employed*

Lack of ground wire and counterpoise protection will doubtless make the line more susceptible to lightning flashovers. However, detrimental effects of circuit trip-outs will be minimized by employing high-speed circuit breaker tripping and reclosure. A pneumatically operated 35-cycle, 115-kv. oil circuit breaker, suitable for later conversion to a 20-cycle breaker if need be, is installed in the line at Vidalia. Capacitor tripping is employed, which eliminates the need for a station battery.

Protective relays capable of instigating breaker tripping in from one to two cycles for all types of line faults between Vidalia and Brunswick are provided which should enable the clearing of faults within five to eight cycles, and without damage to the armor-rodded power conductors. The breaker is also equipped for automatic synchronizing, and bushing capacitance taps are employed to give instantaneous three-phase check for no-voltage on the line after the breaker opens, thus permitting instantaneous breaker reclosure for a "dead" line.

### *Inertia Relays Control Reclosure*

In order that the 115-kv. circuit breaker at Vidalia may open and reclose quickly enough after line flashovers for preventing an interruption to service, means are provided at Brunswick for isolating the small steam plants that may be operating normally in synchronism with the main power system. The inertia relay, developed by Georgia Power Company engineers, makes this possible. A special switching sequence is employed for executing switching in a manner to avoid interrupting service in Brunswick for transient faults involving the 110-kv. line.




**SCHEMATIC DIAGRAM of Vidalia-Brunswick interconnection**

Sequence of operations for 110-kv. line flashover are: (1) Breaker (a) disconnects line from Vidalia source in 5 to 8 cycles. (2) Inertia relays (b) and (c) close contact on rapid frequency drop and trip breakers (e), (g) and (h), isolating all connected generating capacity from 110 kv. source. (3) No-voltage check at Vidalia shows line "dead" and sets up breaker reclosure. (4) Breaker (a) closes restoring normal voltage and frequency to 11-kv. system left connected to the 110-kv. source. (5) Breakers (e), (g) and (h) are resynchronized at convenience.

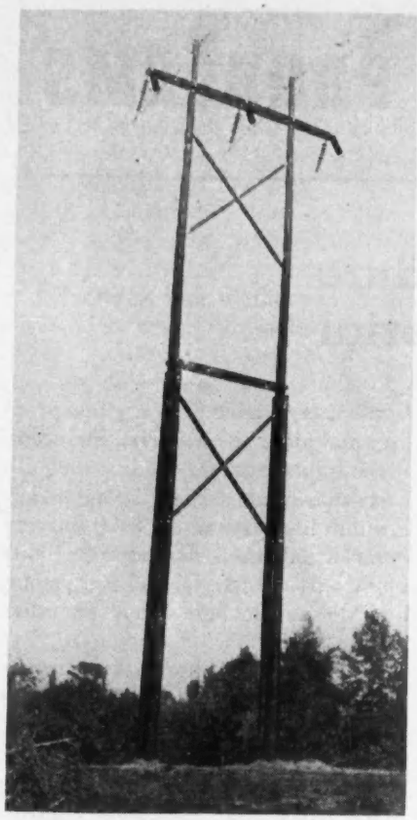
The first four of five operations shown require from 45 cycles in time upward for execution. By "upward" is meant that, should the generating capacity at Brunswick be equal to the load and, further, that the fault-arc extinguishes itself because of reduced fault current when the Vidalia breaker opens, there is no hurry in reclosing the Vidalia breaker. The inertia relays make the decision as to whether the local generation is adequate. If the frequency falls very fast the relays close contact quickly. If the plants show signs of recovery by slow rate of frequency change the relays wait. It is possible for the relays to wait seconds and then decide that the quality of service is not satisfactory, and operate. Under this condition the breaker at Vidalia, waiting "cocked," comes in the instant the line shows dead, picking up its allotted load and averting an interruption to any service in Brunswick. The local generating plants, with their allotted portion of load, will be resynchronized with the 110-kv. source at convenience.

In case the fault-arc breaks after Vidalia breaker opens, and the generating capacity at Brunswick is adequate, the inertia relays will not operate, unless the frequency swings badly. Automatic synchronizing relays at Vidalia will reconnect the Brunswick system to the main system when the two frequencies become reconciled.

### *Underpower Relay*

An underpower relay (i) is provided at industrial plant No. 1. This relay selects which breaker, (d) or (e), the inertia relay will trip. If the plant is supplying load to the power company 11-kv. bus equal to or greater than the island load, obviously the least disturbance would be created by tripping breaker (e). If the island load is appreciably greater than the power being supplied the 11-kv. bus, then tripping breaker (e) would leave the plant overloaded. Consequently the power relay selects breaker (d) for tripping in order that the island will not be interrupted and the industrial plant "swamped."

An inertia relay is not installed at the Brunswick steam plant because local generation in Brunswick will be adequate to carry the entire 11-kv. load when this plant is operating, it being the last plant brought on the line for economy reasons. With this plant operating, together with the three other plants, selector switch (j) at Arco plant is closed to trip breaker (f), leaving the 11-kv. system intact for 110-kv. line interruptions. Under this condition switch (k) at Arco will be open, thereby preventing tripping of breaker (h), and inertia relay (b) will be inoperative. When local generation in Brunswick is not equal to the 11-kv. load selector switch (j) at Arco is closed to trip breaker (g) and switch (k) closed to trip breaker (h). Also, the inertia relay (b) will be in service.



**THREE 667-kva., 110/11-kv. single-phase transformers (they and the steel bases and structure salvaged from other locations) installed to provide fixed boost of 14 percent for 100-mile line; 11-kv. windings connected in line necessitates 110-kv. insulation between tanks and ground**

### *Not An Experiment*

The mere mention of using ground wires for power conductor created much interest, but it must be recognized that this particular conductor differs from standard ACSR conductor only in the relationship of the amount of steel compared to aluminum. In this particular case, had only one or two strands of steel been used with the three strands of aluminum, the conductor could not have been used because of corona limitations.

The art of high-speed switching has been developed on the Georgia Power Company system to the point where transient line faults are of little consequence in so far as the continuity of service is concerned. Disposition of synchronous apparatus once barred the practice of high-speed reclosure in cases similar to the one described in this article, but development of the inertia relay has solved this problem. Some 20 of these relays are now safeguarding loads estimated to be in excess of 150,000 kw. by reducing line outages to disturbances, no more serious than mild voltage surges.

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## Some Group Insurance "Results"

The first nine months of the second year of the Idaho Power Company's Group Hospitalization and Surgical Fee Benefit Plan showed a total of 198 claims paid, averaging $67.50 each, dependents receiving the greater share, in a ratio of more than two to one. Sixty-six employees had personal claims.

Tonsils and adenoids were the popular "items" among employees and their families. Some 50 operations of a miscellaneous character were taken care of. There were twelve occupational injuries, 24 sicknesses and 42 babies were born, including one pair of twins.

The total insurance company claims amounted to $13,375 for a premium of $13,984, a ratio of 95.64 percent.

# PRIORITIES PROBLEMS

## Step-by-step Procedure for Acquiring Material

Priorities rules inevitably interfere with the normal methods of buying materials and equipment. There are certain steps which must be taken and a more or less strict order in which they must be taken if the necessary material with which to maintain essential operation of an electric system is to be obtained. Understanding of these steps removes the uncertainty, if not the paper work, connected with fulfilling these needs.

Suppose, for instance, that a utility needs a circuit breaker. Assuming that it is eligible to buy and use a breaker under the yardsticks of Paragraph F of Utilities Order U-1, the first step is to determine into which of two arbitrary categories the case falls. There are strict rules to determine this. It is for "maintenance, repair and operations (MRO)" if it is to keep property in sound working condition, to replace or repair unusable or unsafe property or, if it is for an addition to existing property. (In property expansion cases, the cost may not exceed $1,500 for installation below ground or $500 for installation elsewhere.) It is also for MRO use if, when used to replace another circuit breaker, the difference in cost between the old and the new units is less than $500.

It is for "construction" if, when it is used to replace another breaker, the difference between the cost of the old and the new unit is more than $500. It is also classified as "construction" if it is added to existing property and all of the material, including the circuit breaker, used in the job costs more than $1,500 in an underground installation or $500 in any other installation. (These cost limits apply only to material and equipment, and do not include labor or other charges.)

Next step, after determining whether the circuit breaker comes within the MRO or the "construction" category, is to consult Schedule C of Order U-1, in which are listed the items subject to inventory control. Circuit breakers are on this list, which means that for units costing $100 or more the utility must, under Paragraph J of Order U-1, attempt to obtain them from the excess inventories of other utilities before going to a supplier. This may be done by directly contacting other companies or by applying to the War Utilities Regional Inventory Control office (ELECTRICAL WORLD, March 20, page 83).

At this point, if the circuit breaker costs less than $100 and is for MRO use, the utility simply prepares a regular order for a supplier and affixes the rating AA-1 assigned by Paragraph B-1 of Order U-1. If, as is generally the case, the breaker costs more than $100, the company contacts the regional inventory control office, which checks its records to determine whether such a breaker may be had from one of the utilities in the region. If it is so available, the purchasing company again applies the automatic AA-1 rating to a purchase order on the owner of the surplus breaker and bargains with him for the equipment.

If no other utility in the region can supply the circuit breaker, the company then makes out a regular purchase order on a supplier or manufacturer, and again assigns the automatic AA-1 rating. The supplier will complete the transaction on the basis of the other rated orders he has. He may extend the rating to replace what he sells.

Both the utility and the supplier, by the terms of Paragraph L-4 must keep copies of the order and any contracts relating to it for two years.

In the event that the circuit breaker falls within the "construction" rather than the MRO definition the procedure is somewhat different. The first step is to file an application for a rating with the Office of War Utilities on a PD-1A or a PD-200 form. If the purchase is authorized, a rating will be assigned by OWU. The utility then applies, as before, to the regional inventory control office. If a breaker is available from another company, it is ordered from its owner, using the rating assigned on the priority certificate. If no other utility can fill the order, then the purchase order, with the assigned rating, goes to a supplier, who will fill the order as he can in view of his other rated orders.

This same procedure is followed for obtaining all other materials and equipment for maintaining utility operations, with this exception: If the items required are "controlled materials" as listed in Schedule B of Order U-1, the indorsement on the order is the CMP symbol MRO-U of Paragraph C instead of the AA-1 rating certification of Paragraph B-1.

**RUTILITIES which want to purchase stocks of a specific item contained in a category of which their inventory is excessive are required to comply with the provisions of Paragraph F-5 of Order U-1. In some cases, however, the company needs the material in less time than that in which it can possibly comply with Paragraph F-5. Procedure in such a case is to wire the Office of War Utilities, asking permission to complete the purchase pending compliance with F-5. In case of a real emergency, the company should order what it needs to meet the emergency and then notify OWU of its action. OWU policy is to back up operating companies in such actions where they can be shown to have been necessary to uninterrupted operation.**

### Inventory Redistribution and Salvage

***Case No. 48***

One of the principal points of the inventory redistribution system recently established by the Office of War Utilities is to supply utilities from excess inventories and thus keep them from competing with war orders for critical materials. One of the many ways in which this objective is accomplished is illustrated by the treatment accorded the request of a co-

operative for permission to acquire transformers, meters and wire for completion of farm extensions authorized under Order U-1-c.

The co-operative asked permission to exceed its allowable quota under Order U-1 to obtain the material. The request was granted conditionally. The co-operative was first required to ascertain how much of its needs could be met by salvage and informed that if salvage would yield all necessary material, it could go ahead with the project without further recourse to Washington. If only a part of the necessary material could be had through salvage, the co-operative was required to obtain authorization to accept the remainder as a delivery over and above its U-1 quota.

When salvage failed to yield sufficient material to complete the extension, the co-op was granted the necessary authorization on condition that it obtain as much as possible of the extra material from excess stocks of other utilities through the regional inventory control office. Thus the co-op was granted sufficient material to complete the extension without reducing its quarterly U-1 quota to a dangerously low point and without competing with war orders.

## Leftover Project Material

*Case No. 49*

In previous case analyses on this page there has been illustrated the proper disposition of inventory of material and equipment held by a utility for an expansion project which has been ordered deferred (Case No. 14, ELECTRICAL WORLD, October 3, 1942, page 53) and for a project which has been suspended (Case No. 38, ELECTRICAL WORLD, December 12, 1942, page 71).

Still confusing to some companies is what to do with material and equipment which are left over upon completion of a utility construction project authorized by the Office of War Utilities. A case in point involves a transmission line extension recently completed to serve a new war factory. The utility asked what it should do with a relatively small amount of wire and cable as well as other accessories purchased for the job in standard quantities but not all required to complete the job.

The answer to the problem is in the definition of "inventory" in Paragraph A of Order U-1. It stipulates that material remaining after completion of a project shall be added to the repair and maintenance inventory. This isn't a delivery of material to be counted against the Paragraph F-1 quota, but its addition to inventory does affect the restriction on deliveries under Paragraph F-2. In other words, if the addition increases inventory in any class of materials, as defined in Schedule A of the order, beyond the maximum permissible working inventory, this would act as a barrier to further deliveries in that class until the excess is used up or is listed for sale as excess stocks under the terms of Paragraph F-5.

## Withdrawals Under U-1-c & d

*Case No. 50*

Many utilities have written to the Office of War Utilities asking whether withdrawals made under provisions of orders U-1-c and U-1-d are to be considered withdrawals from inventory under Utilities Order U-1. The answer to this question is yes.

The reason that such withdrawals must be included in the limits imposed by Paragraph F of Order U-1 is that the accounting system which that section sets up would break down if they were not so included. OWU wants utilities to account for all the material they use, whether it is automatically withdrawn under the allowable quotas established in Paragraph F of Order U-1 or whether it is withdrawn after special authorization has been obtained.

Utilities are advised that if extensions permitted by U-1-c or U-1-d cannot be completed under the allowable withdrawals from inventory authorized by U-1, they should ask special authorization to make withdrawals sufficient to complete the extensions. Requests will be authorized on a quarterly basis. Normally, such requests will be granted, for OWU has an interest in seeing the provisions of those orders carried out wherever possible. The fact that a special request is made will not imperil the chances of obtaining the release of needed materials, but it will allow OWU's materials bookkeeping system to function as intended.

## How to Obtain An Increased Inventory Quota

*Case No. 51*

Procedure for obtaining authorization for an increase in the practical working minimum inventory allowable under Paragraph F (2) of Order U-1 is a simple one.

Many utilities, feeling that the restrictions imposed by the current order are entirely too strict, have sent lengthy and minutely-detailed documents to the Office of War Utilities to back up their requests for increased inventories.

Normally, these requests are granted, since it is OWU policy to see that utilities have reasonable working inventories and are permitted adequate use of materials. This is based on the twin duties of OWU to see not only that utilities do not use more critical material than they need, but also to insure that they receive what is necessary for maintenance of operation.

It isn't necessary, however, to prepare an elaborate application to obtain this relief. Requests for changes in allowable inventory should be made in letter form. Letters should contain comparisons between the inventories allowable under the October 10, 1942, version of Order P-46, and those allowable under U-1. They should also contain estimates of inventory needs shown by each of the eight material control classes established in Schedule A of Order U-1 for which relief is requested.

**R THE CMP ALLOTMENT SYMBOL—MRO-U—provided in Utilities Order U-1 for obtaining utility repair, maintenance and operating materials is specifically designated as the equivalent of a CMP allotment number under all the rules and regulations of the Controlled Materials Plan. In other words, the symbol MRO-U has the same standing for obtaining needed materials as the CMP symbols with code numbers. Only reason for the difference is bookkeeping within WPB. Controlled materials for utility maintenance are allocated in bulk to the Office of War Utilities and individual utility withdrawals from the stockpile are limited by Order U-1's Paragraph F. Materials allocated with an allotment number are accounted for in terms of specific projects or products.**

# Editorials

S. B. WILLIAMS, *Editor*

## *A Warning to Co-Ops That Would Serve Large Power Loads*

SEVERAL WEEKS AGO the Public Service Commission of Indiana in granting a certificate of necessity to a power company to serve an Army camp located within a rural co-op territory pointed out that when a co-op takes on customers other than members it becomes a utility, and as such would be subject to regulation. We commented on the soundness of this order in our issue of March 6, 1943.

Because there was some publicity to the effect that the commission had held that co-ops under the state act were not permitted to serve large power users, the decision was withdrawn and in its stead a warning was sounded to the effect that service of large power loads by co-ops could endanger service to the users for which the co-op was set up and that this clearly was not in the public interest.

This second decision, while written to relieve the commission of any criticism that it had stepped beyond its bounds, seems to add some good common sense to the theory of co-op management. Large power loads place an added responsibility on co-op personnel. If the load is transient—as Army camps and many other war loads are —then there is the future liability for the more expensive equipment that will be saddled on co-op members.

The new decision, however, does not in any way change the fact that a co-op secures special consideration from regulation only because it is serving itself. In other words, there is no consumer interest to protect against some outside proprietary interest. However, when a co-op itself becomes proprietary, it is the same as any other utility. What difference does it make whether the ownership is a group of farmers or a group of stockholders—it's the same kind of service.

This kind of thinking is not anti-co-op. In fact, in years to come co-ops will find it the most friendly advice they could get.

The whole philosophy of government-financed rural co-ops is the extension of service to unserved areas through mutuality of ownership. The moment a co-op becomes a business operating at a profit it loses all advantages it otherwise might have. Since it is not a public body, it cannot escape taxes, nor can it escape regulatory restriction once it becomes anything other than a mutual organization serving only its own members.

## *Government Without Right to Break Established Rates*

IN THE ABSENCE of congressional legislation the government has no authority to demand for itself, its agencies or contractors power rates below those approved by a state utility commission, is one interpretation of the recent Supreme Court decision in the Pennsylvania milk case. This decision appears to be controlling in all cases coming under the President's directives of last fall as to renegotiation or as to "common carrier" supply in those states which have utility regulatory bodies.

Pennsylvania's Milk Control Commission had established minimum prices for fluid milk, which one dairy cut in bidding and accepting an Army contract for supply within the state. The dairy was required by the commission to show cause why its license should not be denied for selling below the established minimum. One court after another sustained the commission, and these in turn have now been upheld by the United States Supreme Court.

"We have recognized," says the court, "that the Constitution presupposes the continued existence of the states functioning in co-ordination with the national government, with authority in the states to lay taxes and to regulate their internal affairs and policy, and that state regulation, like state taxation, inevitably imposes some burdens on the national government and of the same kind as those imposed on citizens of the United States within the state's borders."

For some time there has been a struggle between government agencies and the states over authority to regulate utilities in intrastate operations. Of late there has been the assumption that the national government is immune, especially in time of war, to such regulation. This decision emphatically denies that immunity.

Only Congress can grant such immunity by changing the Constitution. This would imply that the President was usurping congressional rights, for which he has no authority, in issuing his "cheapest service" directive.

Under this ruling any utility, it seems to us, is justified in refusing to renegotiate a power contract for a government property or war contractor when the rates are in accordance with those approved by the state commission. The national government, unless specifically authorized by Congress, has no rights to prices below those authorized by the state regulatory body.

Likewise it seems to us that the effect of this decision on the "common carrier" philosophy is equally clear. If a government property can demand "common carrier" sup-

ply, then so can any other customer, because the government has no rights to this beyond those of any citizen. Obviously, this would destroy state authority and regulation.

The decision is extremely clear and appears to the lay mind as being most forthright. Certainly it is timely.

## *Light on the Working Plane Wherever It Is*

REPEATEDLY there come reports on the lighting of industrial interiors that give the number of horizontal foot-candles, average or otherwise, and we have been equally guilty with the rest in publishing them. What do they mean? Very little to one who is familiar with industrial work habits.

All these readings are taken on a horizontal plane, but the bulk of the critical seeing problems in factories is not on the horizontal. It is something else. Except for inspection and packing, the work is very largely done at some angle from the horizontal all the way to 90 deg.

Horizontal plane lighting, of course, shows higher values from overhead illumination, but what we want to know is how much lighting is available where it is to be used. In the earlier days of lighting much was made of this, but latterly, in our efforts to get higher and higher intensity, we seem to have lost track of the distribution in all planes.

Workers on vertical and near-vertical surfaces were found recently trying to do fairly careful work with less than 10 foot-candles, although the general illumination horizontally was of the order of 35 foot-candles or higher. And this job was exhibited as a fairly good lighting job.

Too long have we worshiped at the altar of higher foot-candles on the horizontal. Isn't it time to direct our thinking back to light on the plane of work?

## *No Electrical Problem With Silver for Busbars*

COPPER is scarce but silver is plentiful in the U. S. Treasury—some 3 billion troy ounces. So some 17,000 tons of silver was loaned to the Defense Plant Corporation for use as electrical conductor material in essential war plants. Electrically speaking, there was no problem whatever in the substitution because silver has weight, resistivity and strength near enough to copper to take its place structurally and electrically. It will have lower losses, higher conductivity and far less tendency to corrosion. Installation and design, therefore, meant practically no difference to the engineers charged with the layout and erection.

But the fabrication did present many problems, the largest being the requirement that every scrap and chip must go back to the Treasury for credit when the war is over. To reduce the possible loss of silver chips by drilling and sawing, the necessary bolt holes were punched and the bars rolled to exact width rather than sawed. In handling it during shipment the workmen had to avoid abrasion.

An earlier problem was presented by the rolling process. No plant regularly rolling silver had anywhere near the capacity to handle either the sizes or quantities required. So the Treasury bullion was shipped to a copper refinery, where it was cast in a built-over copper furnace. Any silver volatilized was collected and the silver remaining in the furnace will be reclaimed when it is dismantled. Rolling was done in a brass mill.

It was a startling move to use 150 million dollars worth of precious metal for the sake of releasing 5 million dollars worth of scarce copper. But the engineer just took it in his stride when he was confronted with applying it. It was just one more substitution—in this case somewhat in reverse. He knew how to keep it from being wasted or stolen. It's all in big pieces and in a few places where it is well guarded and continuously energized. It will all be there and hardly more than tarnished when Uncle Sam wants it back.

## *No Work Stoppage for Any Reason Whatsoever*

IN ACCEPTING earlier this month the Army-Navy "E" President Thomas of Thomas & Betts Company stated, "since we first started in business, we have never had a work stoppage for any reason whatsoever."

This isn't a solitary instance of work continuity, but in these days of extreme labor unrest it is refreshing to learn of an instance where the relationship between labor and management is such that differences can be worked out harmoniously without interruption. Nor could we help wondering how much further ahead the United Nations would be in their war progress if this same thing could have been said of every contractor on war work.

One reason why manufacturers can point proudly to such records is that they have maintained close touch personally with their employees. They have understood the problems of labor and have handled them with an open mind.

Good labor relations, however, implies understanding and a willingness to face problems together by both sides. Labor is equally responsible with management, especially when organized as in this case. The record speaks well for this recognition of inter-responsibility.

To all manufacturers in this industry of ours and their employees who also can say "we have had no work stoppage" we pay tribute for a splendid contribution to the war effort.

## *Washington Comment*

*GEORGE E. DOYING, Jr., Washington Corespondent*

# OPA's Viewpoint on Utility Rates

SO FAR as the Office of Price Administration and Economic Czar Byrnes are concerned, utilities are just as much subject to the government's over-all economic stabilization policies as any other business. Realization of this fact—quite aside from acceptance—is the key to understanding OPA's activities in the utility rate field since enactment of inflation control legislation last October, as well as the key to future probabilities.

Only the procedure for applying stabilization policies to utilities is different! In the business field OPA calls the shots directly through issuance of price ceiling regulations. In matters involving utility rates the agency's authority is limited to attempting to persuade the regulatory agencies to its viewpoint. Failing in this, however, OPA has shown no hesitancy about taking its contentions into court.

### *No Exemption Now*

Enactment of the stabilization law ended the exemption which utility rates had under the original Price Control Act. The October 2 statute requires that utilities notify OPA 30 days before the effective date of any general increase in rates and accept OPA intervention before the regulatory body with jurisdiction.

OPA sees this provision as simply a requirement upon utilities, not a limitation upon the stabilization program. To the extent that OPA can gain permission to intervene in rate matters before regulatory bodies, it considers it has the right to seek to influence utility charges, including attempts to reduce tariffs where this will contribute to stabilization. This attitude is succinctly put in OPA's brief in the recent rail freight rate case before the Interstate Commerce Commission: "It is submitted that it is inequitable to permit the railroads to share in the benefits of price control without requiring them to bear their share of the burden imposed by the price stabilization program."

Application of this concept starts from the premise that normal rate-making formulas should not be controlling in fixing wartime rates. OPA stated its position on this point in a Florida rail rate case—"The Price Administrator is absolutely and unequivocally opposed" to the theory "that the carriers are entitled to reasonable rates as determined by the time-honored measures heretofore used" by regulatory commissions.

What is OPA's substitute formula for determining wartime rates? The same brief supplies the answer. "The Office of Price Administration has adopted this general policy: What is the over-all profit position of an industry or of a field that seeks a price increase? . . . Requests for increases should be denied in spite of ability to demonstrate that profits on individual items do not exist if the firm's over-all profit position is sound."

That is definitely OPA's position regarding escalator rate provisions covering fuel and commodity costs, and taxes. OPA has taken the stand that all filed rate schedules to which any customer meeting the terms is eligible are "general" rates within the meaning of the law regardless of the number of customers being served. Therefore, upward adjustments under escalator clauses are considered by OPA in the light of the system's over-all profit situation, not the compensatory nature of the schedule involved.

### *Rate Reductions, Too*

But OPA is not interested solely in preventing rate increases. "Reduction of prices where profits are excessive is an integral part of national policy and economic stabilization," says the agency's brief in the rail freight rate case before the ICC. The brief goes on as follows:

". . . a guiding principle of the administration of the General Maximum Price Regulation has been that . . . prices which yielded better than reasonable earnings, and which at the same time resulted in costs that were unbearable under price ceilings at the next stage of production or distribution, were reduced."

OPA has carried this philosophy into the electric rate field in its fight to scrap the Washington, D. C., "sliding scale" agreement and bring about a major pruning of Potomac Electric Power Co. income. Cost of living in Washington has increased and Pepco is making abnormal profits, in OPA's view. Ergo, a reduction in Pepco's rates helps to stabilize living costs in the nation's capital! The Public Utilities Commission's refusal to accept the OPA thesis is certain to wind up in the courts, just as did the commission's previous refusal to junk the "sliding scale" formula for Washington gas rates. First round of the gas case was won by OPA when the district court held that the economic stabilization policies established by Congress are superior to the gas company's agreement with the District of Columbia.

### *Only One Reason Accepted*

Is there, then, any room left for utility rate increases under war conditions? Only where such a step is necessary to preserve the financial ability of the utility to continue rendering service, says Robert A. Nixon, chief of OPA's utility division. His answer traces back to the ruling of the Wisconsin Public Service Commission in a telephone case over a year ago—a case upon which Mr. Nixon sat as a member of that body.

Mr. Nixon does not expect that all utilities are going to agree with OPA's philosophy of economic stabilization. But to date, at least, most of the regulatory agencies which have acted have heeded OPA's urgings in rate cases. Up to now, however, the issue hasn't been very sharply drawn as to utilities providing electric, gas and telephone service; these rates have held firm. The transportation field, particularly taxis and common carriers, is different; rates are rising and there is much less regulatory jurisdiction through which OPA can work.

# NEWS OF THE WEEK

## New 1943 Capacity Seen Meeting Heavy War Loads

***Additional 4,000,000 kw., scheduled for completion this year, should serve nation's emergency power needs, C. W. Kellogg tells Middle West Power Conference — Proposed "brownout" unjustified, he says***

New electric generating capacity, amounting to 4,000,000 kw., scheduled for completion this year should be sufficient to care for the nation's electric power needs in 1943 without depleting reserves, C. W. Kellogg, president of the Edison Electric Institute, told more than 600 engineer delegates to the sixth annual Midwest Power Conference in Chicago last week.

### *Small Increase in Peak Load*

In discussing the nation's wartime power supply situation, Mr. Kellogg pointed out that expenditures for war have increased tenfold in the past two years. Non-coincident peak load on the nation's power systems in the same period, however, has increased only about 15 percent, or from 31,500,000 kw. to 36,900,000 kw., and the margin between peak and capacity is about the same as it was two years ago.

Ability to meet such huge war power requirements with only a 15 percent increase in maximum power load lies, Mr. Kellogg believed, principally in the substitution of war for peace measures; reducing civilian activity to just enough to keep the war machine going. But, he asserted, it has also been effected by power pooling and the change to "war time," both being reflected in higher load factor.

The Office of War Utilities, Mr. Kellogg pointed out, is watching the situation constantly and with the greatest care. The nation and the industry have been fortunate in having the over-all direction of their power affairs in such careful and competent hands, he stated.

In view of lowered public morale, increased crime and street traffic fatalities, Mr. Kellogg felt the "brownout," proposed to save fuel and transportation, was unjustified. It would reduce energy output only 1½ percent and the nation's coal consumption only 0.2 percent, he estimated.

In his remarks welcoming delegates to the conference H. B. Gear, vice-president Commonwealth Edison Co., reviewed the effect of war loads on utility systems. In Chicago, Mr. Gear said, the replacement of a sharp evening peak by a comparatively broad morning peak, coupled with two- and three-shift operation in war plants, has improved the use factor of utility plants. Advent of new war loads has stopped the decline in system peaks between January and midsummer by the first of May and reduced the depth of the valley in July and August. This has necessitated overhaul of equipment in the early months of the year and a reduction of outages after July 1.

### *Power Station Design*

Future conservation developments in the design of power stations were foreseen by F. H. Hollister, Sargent & Lundy, Chicago, through: Increased standardization of equipment; extension of hydrogen cooling; substitution of reinforced concrete for steel in buildings; omission of windows and improved air conditioning; simplified systems of auxiliary power distribution;

**POWER CONFERENCE PRINCIPALS** — Snapped at the sixth annual Midwest Power Conference last week were the following: H. B. Gear, vice-president of the Commonwealth Edison Co.; H. O. Croft, University of Iowa; Charles W. Kellogg, president Edison Electric Institute (keynote speaker); M. P. Cleghorn, Iowa State College; Philip W. Swain, editor of *Power*; Stanton E. Winston, Illinois Institute of Technology and director of the conference

design of plants with turbines and boilers partly or wholly outdoors; use of silver for copper in plant buses, should the war continue; improvement in cooling of transformers with air; operation of cables at higher temperatures; more economical use of cable and the elimination of duplicate feeds with improvements in protective devices.

C. F. Wagner, Westinghouse Electric & Manufacturing Co., said that while it is difficult in normal times to justify capacitors at generator terminals to supply MVAR, unless power factor is very low, the premium on generating capacity in wartime makes it desirable to confine generators to generation and to relieve them of supplying reactive power by the use of capacitors. On isolated pieces of equipment or lines he pointed out capacitors reduce the amount of current for the same kw. load, improve voltage levels and, if properly switched, give better regulation and finally reduce resistance and reactance losses.

Filling in a gap in the technical literature on Petersen coil grounding of transmission lines, Dr. W. A. Lewis, Cornell University, presented an analysis of resonant grounding of long transmission lines for the case where the distributed nature of system inductive and capacitive reactance cannot be ignored. He concluded that resonant grounding for such system can be obtained, and that for a line of 150 miles or less with a single reactor or 300 miles or less, with a reactor at both ends, the correction for distributed constants will usually not exceed 5 percent and can be ignored.

While automatic control for steam stations is not a panacea for all operating ills, H. H. Gorrie, Bailey Meter Co., found it a medium that will help plant operators to meet peak loads continuously in spite of fuel shortages, inexperienced personnel and limited plant capacity, if intelligently used from the standpoint of adjustment to individual plant needs and proper maintenance and inspection.

### *Other Contributions*

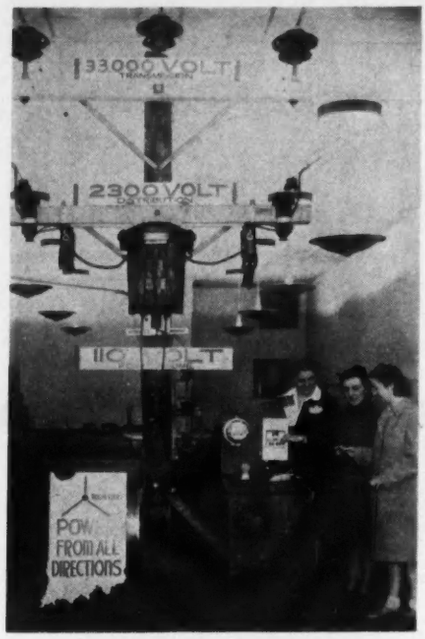
A. C. Foster, Foster-Wheeler Corp., discussed in detail the maintenance of boilers and auxiliaries under wartime conditions. He emphasized the importance of advance planning in any program of preventive maintenance.

Relatively new deposits of insoluble silica ($SiO_2$) being experienced on turbine blades in the temperature range of the turbine between 400 to 550 deg. F. were discussed by Prof. F. G. Straub, University of Illinois. Amount of insoluble silica deposits are not directly related to the soluble silica content of the boiler water, he felt. But it is possible, he indicated, that a proper balance of chemicals in the boiler water might reduce the deposits, as might also an increase in the temperature in the lower turbine stages.

D. B. Jones, Hall Laboratories, Pittsburgh, discussed the control of concentration deposits, silicate reduction, dissolved oxygen, copper accumulation, carryover and related problems in high-pressure boilers.

D. L. Beeman, General Electric Co., presented a summary of the January A.I.E.E. paper on wartime industrial applications of electrical equipment entitled "A Proposed Wartime Guide for Industrial Power Applications," which is a guide to the design and selection of equipment for industrial power distribution systems.

The army engineering hour, a new feature of the Midwest Power Conference, featured an appeal by Major-Gen. Reybold, Chief of Engineers, U. S. Army, read by Gen. Charles Keller urging the engineering profession to contribute men with engineer training to the U. S. Army Engineer Corps. Men sent to any engineer office of the Army, if qualified, will be given a letter to their induction station earmarking them for the Engineer Corps, it was stated.




**MINIATURE "POWER SYSTEM"—For the benefit of customers, the Rochester office of Public Service Co. of Indiana, Inc., recently set up this miniature "power system" which depicts everything except a generating plant. Alida Grove, distribution service clerk, has described the procedure of turning on the service and is shown demonstrating the merits of adequate wiring**

## NEWS BRIEFS

TOLEDO EDISON is sponsoring a 15-minute radio program on Fridays at 7:30 p.m. over WSPD to aid in maintaining and improving the company's contact with its customers during the war emergency. The programs are entitled "War Correspondent" and are prepared by the AP.

MISSISSIPPI POWER & LIGHT has announced the establishment of a "Wartime Placement Service" for the buying, selling and exchanging of electrical appliances. Interested parties will deal directly with each other, the company simply acting as a clearing house of market information on used appliances.

A BIG CRANE being transported over the Erie Railroad lines pulled a power line from its moorings recently and, in falling, the wires set afire the brush on the ground. The resulting confusion caused a break in the service to Rockland County, N. Y., residents which lasted close to two hours.

YORK ICE MACHINERY is building a new tunnel at an army air field proving ground which will provide man-made gales 67 deg. below zero to test the endurance of stratosphere bombers and fighters. The equipment will produce more than 4,000,000 cu.ft. of refrigerated air a minute.

FOR EMPLOYEES ON DUTY with the armed forces in foreign lands Wisconsin Public Service Corp. has printed a limited edition of its annual report on light-weight Bible paper. Total weight with suitable envelope is well within the recommended 2 oz. limit. Except for the paper used, the edition is identical with the regular one.

CENTRAL MAINE POWER will save 20,000,000 gal. of fuel oil annually on the present operating basis at the Mason, Bucksport and Biddeford steam plants through conversion to coal. To convert 35,000 kw. to coal burning the company is expending about $785,000 at Mason and Bucksport, and about 90 percent of the steam-generated output on the system will be coal produced.

SIMPLEX WIRE & CABLE has received a certificate from the American College of Surgeons approving the medical service, dispensary, nursing and hospital facilities furnished employees at its plant in Cambridge, Mass. The plant hospital staff consists of a resident physician, four graduate nurses, two fourth-year medical students and two secretaries, 24-hour service being provided for employees.

# Charges FPC Ignored Tax Load on "Cheap Power"

***Commission not carrying out President's directive, says Representative Ditter, following hearing on FPC order requiring utility to act as "common carrier" for Bonneville power***

Rep. J. William Ditter, Pennsylvania Republican, has charged the Federal Power Commission with having "collusive knowledge" of a "dummy political corporation, the Clark County (Washington) Public Utility District," which "sits between two other federal agencies and collects $50,000 a year for rendering absolutely no service."

### *FPC Denies Charges*

The Bonneville Power Administration, selling power wholesale to the PUD, and the Federal Housing Administration, buying it retail from the PUD, also were charged with "collusive knowledge" of the situation. The charge was denied by FPC and by two spokesmen for the PUD.

In addition, Ditter charged FPC with failure to carry out the President's directive of October 22 which required FPC to see that federal establishments and war contractors get their power from the cheapest feasible source, using competitors' facilities to do so if necessary. FPC denied this charge with the statement that the contract in question was made five months before issuance of the directive and that proposed contracts must be reviewed prior to contracts which antedated the order.

Ditter countered the denial with a statement that his "most important charge" was that FPC refused to consider federal taxes paid by private companies in determining the cheapest source. This accusation, he said, was paramount to any one interested in private enterprise. He added that since FPC's denial made no mention of this fact, "I interpret this omission as tacit acceptance of this charge."

Ditter's blast followed an FPC hearing on the Washington Water Power Co.'s request for public review of the FPC order directing the company to transmit Bonneville Power as a "common carrier" to an Army hospital and camp pumping station in the company's territory. The company's attempt to introduce evidence showing that its rates would be cheaper than those offered by Bonneville if its federal taxes were considered was disallowed by the examiner (ELECTRICAL WORLD, April 10, 1943, page 5).

Ditter further assailed FPC for its willingness to "violate its own rules and to vitiate the contract already entered into by the parties" (Bonneville and Washington Water Power), basing the accusation on FPC's common carrier order against the company.

The hospital load, Ditter said, totaled 700 kw., the camp load, 500 kw. Previously, Ditter charged on the House floor, FPC had established as "a reasonable minimum for renegotiation loads in excess of 1,000 kw." Thus, he explained, it violated its own rules by the common carrier order affecting contracts smaller than 1,000 kw. Further, Ditter charged, Bonneville and Washington Water Power had an exchange contract which provided that Bonneville was to take war loads of more than 750 kw., leaving smaller loads to the company. This agreement was vitiated by FPC's order, Ditter alleged.

Ditter paid incidental tribute to the electric power industry with the statement:

"The (Presidential) order was singular only in that electric power is the one vital war production commodity which has not been rationed, in which there has not been a shortage and which has actually decreased in price to the consumer since the war began. This, despite the fact that on as many as eleven different occasions FPC erroneously surveyed power resources of the nation and erroneosuly predicted shortages which failed to appear."

### *Rep. Norman Defends PUD*

Rep. Fred Norman, Washington Republican, took the House floor to defend the Clark County PUD, located in his district, and denied allegations that it was a "political parasite" or "dummy." Norman explained that the commissioners who organized it had been re-elected to office after its establishment, and termed this a "redemonstration of confidence." He pointed out also that Bonneville wholesales power to other Washington State PUDs and to private companies as well, all of whom retail it to the public.

"There is nothing wrong in all this, and there certainly is nothing wrong with the fact that both the public and private power retailers make profits," Norman declared. "They show these profits through intelligent, efficient and, I might add, publicly approved operation."

R. H. Hendricks, press representative

**THOMAS & BETTS "E"—April 2 was a proud day for the Thomas & Betts Co. The company's record in producing war goods was signalized by the award of the coveted Army-Navy "E" pennant and the event was accorded an impressive ceremony. In the picture above Commander Samuel J. Singer, U.S.N.R.; George C. Thomas, president of the company and recent president of the N.E.M.A.; Joseph Gries, president of Local 1068B, I.B.E.W., and Clarence E. Boesch, Corps of Engineers, U.S. Army, hold up the flag for the crowd to see. In World War I the company received the War Department award for Excellence**

for the Clark County PUD, also denied Ditter's charges. Most of the $50,000 difference between the Bonneville wholesale and PUD retail rates, he said, "goes to meet maintenance expenses." He scoffed at Ditter's statement that the physical assets of the PUD consist of "a little office furniture and exactly two electric power meters worth not more than a few hundred dollars."

FPC's reply to the Ditter allegations laid most emphasis on its denial of the charge that it tried to "gag" the Washington Water Power hearing by attempting to bar the public and press for reasons of military security. FPC pointed out that newsmen had been present both at the open and executive sessions of the hearing.

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## Stabilization Order Bars Rate Increases

### *Decreases also called for in "Hold the Line" Message*

The President's "hold the line" stabilization order of April 8 calls upon local, state and federal regulatory agencies to disapprove utility rate increases and to bring about actual decreases consistent with the law "in order to keep down the cost of living and effectuate the purpose" of the program."

This action marks the first time that utility rate cuts have been openly advocated as a part of the stabilization program. The President's policy in this respect coincides with the philosophy of the Office of Price Administration that because some price increases are inevitable some price cuts are necessary to maintain a cost-of-living balance (see Washington Comment, page 78, this issue).

#### *Text of Rate Message*

Text of that section of the stabilization order dealing with utility rates follows:

"The attention of all agencies of the federal government, and of all state and municipal authorities, concerned with the rates of common carriers or other public utilities, is directed to the stabilization program of which this order is a part so that rate increases will be disapproved and rate reductions effected, consistently with the act of October 2, 1942, and other applicable federal, state or municipal law, in order to keep down the cost of living and effectuate the purpose of the stabilization program."

# River Authorities Probe Is Continued in Texas

***Bill introduced, regulating and limiting their powers, is one outgrowth of Legislature's investigation into purchase of the San Antonio Public Service Co. — LCRA officials testify***

The continuing investigation by the Texas Legislature into the sale of the San Antonio Public Service Co. to the city and the part played in the transaction by the Guadaloupe-Blanco River Authority and the Lower Colorado River Authority (ELECTRICAL WORLD, April 3, page 69) resulted recently in the introduction of a bill regulating and limiting the powers of river authorities, despite vigorous opposition from representatives of many Texas rural co-operatives.

#### *Principal Features*

Principal features of the bill (H. B. 230), amended somewhat from its original drastic form, provide:

1. It shall be unlawful for any state power agency to acquire the electric distribution system of any city unless the city by ordinance favors such sale and has the right to repurchase, without profit to the agency, less depreciation.

2. It shall be unlawful for the agency to pay any commission or fee in connection with acquisition of electric power property.

3. It shall be unlawful for a state power agency to fix the resale price of current sold to cities, co-ops or associations.

4. It shall be unlawful for the agency to make loans.

Another provision of the bill sets up a flood-control fund into which 15 percent of the river authorities revenue must go, after deducting fixed charges, operating costs and replacement expenses.

The bill, sponsored by Rep. Marshall Bell, whose resolution started the river authority probe, was favorably reported out of committee to the House.

Meantime, the investigation into the San Antonio utility deal brought the third party to the transaction—the Lower Colorado River Authority—under the questioning fire of the Texas legislators. Up before the committee were W. B. Arnold, chairman of the board of LCRA; W. S. Gideon, general counsel, and Max Starcke, general manager. Under insistent questioning, Starcke admitted that the city of San Antonio would have been $7,500,000 "better off" by dealing direct with the LCRA in leasing the Comal County plant of the utility, rather than going through the Guadaloupe-Blanco River Authority. This admission brought from committee chairman Joe Ed Winfree the comment that San Antonio public officials who negotiated the complicated deal were "dumb clucks." The LCRA, Starcke said, only came into the deal when it appeared that a stalemate between GBRA and the city would result in the whole matter being dropped.

#### *Cite Fees Paid*

Of special interest to investigators was testimony revealing the high sums paid to legal counsel, negotiators and "brokers" by river authorities. Former state Senator Alvin J. Wirtz and W. S. Gideon, acting as attorneys for the LCRA, had received salaries and expenses, since 1935, totaling $163,581, it was charged. D. W. Glasscock, who acted as agent to acquire the San Antonio properties for the LCRA, received $20,000 and E. M. Cape, general manager of the GBRA, $25,000. Subsequently, the checks paid the various negotiators were returned by them. Wirtz, who has been called the "spark-plug" of the whole utility purchase deal, said that fees paid him were reasonable and suggested that the House investigate fees paid by other companies with which the LCRA has had dealings.

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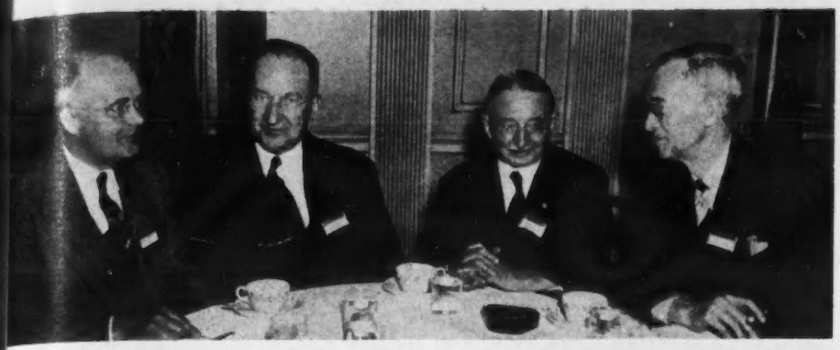
## Spanish Edition of NEC to Be Published

Decision has been made to translate and publish the National Electrical Code in Spanish, in accordance with plans announced earlier this year, National Electrical Manufacturers Association has announced.

This undertaking is made possible by the action of more than fifty member companies in supporting the plan developed by the NEMA committee on the promotion of the National Electrical Code in South America, John W. White, chairman, and vice-president and general manager Westinghouse Electric International Co.



TECHNICAL GROUP — L. to r., M. S. Oldacre, Commonwealth Edison, Chicago; R. T. Henry, Buffalo Niagara & Eastern Power Corp.; M. O. Troy, General Electric, Schenectady; V. M. Montsinger, General Electric, Pittsfield

# Wartime Electrical Tasks Programmed at Pittsfield

***A.I.E.E. district meeting notes progress in equipment design, materials and methods stimulated by emergency — Post-war planning discussed***

Three hundred engineers mobilized at Pittsfield, Mass., on April 7-9 at the Northeastern District Technical Meeting of the A.I.E.E. to discuss problems vitalized by the war and broaden their knowledge of apparatus, materials and techniques now in use in power supply, measurements, plastics, industrial electrical applications, electronics and communication, besides looking into planning for post-war conditions and studying personnel training and supply matters in industry, the armed services and colleges.

### *Power Supply Session*

In the power supply session S. Minneci and S. B. Farnham (G.E.) featured a new control system for automatic parallel operation of load ratio control transformers, separating load and circulating currents and providing highly flexible service. M. S. Oldacre (Commonwealth Edison) presented a method of calculating equivalent annual ambient temperatures from Weather Bureau records to carry transformer and regulator loadings to higher values. In the discussion it was conceded that war conditions might justify forcing loads higher, but that the subject needs further study in view of the variables involved. Provocative data on electric rating of overhead wires on a thermal basis were given by Myron Zucker (Jim Handy Organization, Detroit), and Reinhold Rudenberg (Harvard University) discussed various frequencies of interconnected power from the mathematical viewpoint, with identification of certain tuning conditions aiding stability.

Four conference papers on plastics threw much new light on their respective electrical properties and appropriate applications. Turner Alfrey (Monsanto), in presenting data for a wide range of thermoplastics, rated polystyrene as high in all-round manifestations of power factor, dielectric strength and water resistance, but inherently weak in mechanical properties unless reinforced. C. W. Blount (Bakelite) focussed on the significance of loss factor of the thermosets and mentioned the constant pressure of industry to still further improve their moldability; he cautioned against extrapolating dielectric strength from the volt-per-mil values. Laminated plastics were discussed by P. B. Leverette (General Electric) in the light of the eleven grades prescribed by NEMA; melamines show potentiality for superior properties; the compregnated woods give promise for mechanical shapes, but more data are needed on their electrical properties. He mentioned the necessity of using Carboloy tools for machining and alloy steels for molding plasticized fiber-glass.

A gasketless potential transformer which has 40 percent of the weight and 15 percent of the oil of conventional designs was described by G. Camilli (General Electric) and mention was made by H. W. Bousman and R. L. Ten-Broeck of a new capacitance bridge for determining ratios and phase angles of potential transformers. Another measurement paper by R. H. Kaufmann and Camilli detailed a thyrite-disk device which limits abnormal rise in secondary volts of current transformers on surges, faults and opened secondary circuits.

In an industrial operating session, the effectiveness of silver-plating of contacts and of avoidance of over-lubrication of motors was stressed. Chairman J. J. Orr (U. S. Rubber) told of 40,000 identical fractional-horsepower motors on continuous loading which showed fewer bearing troubles as greasing was extended to four years and then abandoned entirely in favor of replacing bearings. Discussion of static electricity hazards tended to indicate that the ideal corrective is still to be sought for processes where humidification is impracticable.

### *Electric Welding*

Advances in the control of electric welding apparatus for both manual and automatic operation were discussed at a session on this subject. It was brought out that capacitor applications have

OFFICIAL HUDDLE — L. to r., Dr. K. B. McEachron, General Electric, Pittsfield, A.I.E.E. vice-president; Mayor James Fallon, Pittsfield; President Harold S. Osborne, A.I.E.E.

greatly reduced former voltage distubances on supply systems. A.c. welding is making major strides in war industries. More data are needed on demands of arc welding equipment. Diversities are running higher and techniques improving, in arc welding, resistance welding, spot welding and electric brazing. Prof. J. H. Lampe (University of Connecticut) presided, and the participants included E. F. Potter, R. F. Wyer and W. C. Reed (G.E.) and Dr. W. F. Hess (Rensselaer Polytechnic), with a demonstration after the session. Mass production is essential to the most successful use of electric brazing, it was maintained.

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## WPB Rescinds Ban on 32 Co-op Jobs

### *Projects 71 percent complete given green light*

The War Production Board has rescinded its "stop work" order halting construction of 32 Rural Electrification Administration co-operatives' projects and will allow the jobs to be finished as a contribution to the food production program. The decision was made by WPB Chairman Nelson, on the basis of re-survey reports made to him by the Office of War Utilities and by the Department of Agriculture.

The projects involved are those which were in the "40 percent or more complete" category on Pearl Harbor Day. Originally WPB authorized their completion, but last July 21 authorization was withdrawn.

#### *Service for 6,700 Farms*

Announcing the lifting of the ban, Mr. Nelson said that the projects would provide electric service to 6,700 farms and that most of the material required to complete the jobs, now an average of 71 percent complete, could be obtained from excess inventories. "From a practical standpoint," he said, "no other use exists for these frozen stocks comparable to the benefits to be obtained from completing the electrification of these farms."

Involved in the completion are 1,000 tons of steel wire, 560 tons of copper-weld-copper wire and 80 tons of weatherproof copper wire, all except 750 tons of steel wire of which is available in inventories.

The reinstated projects and the amount of line involved are:

Intermountain Rural Electric Assn., 114.9 miles in Jefferson County, Colorado; Calloway County Electric Co-operative Assn., 27.3 miles in Calloway County, Missouri; R. S. R. Electric Co-operative, 177 miles in Sargent County, North Dakota; Tallahatchie Valley Electric Power Assn., 48.6 miles in Panola County, Mississippi; Palmetto Electric Co-operative, 78 miles in Hampton County, South Carolina; Claverack Electric Co-operative, 104 miles in Bradford County, Pennsylvania; Dairyland Electric Co-operative, 33 miles in Itasca County, Minnesota.

Also, Clearwater Valley Light & Power, 57.8 miles in Nez Perce County, Idaho; Fort Belknap Electric Co-operative, 205 miles in Young County, Texas; Dawson County Public Power district, 120 miles in Dawson County, Nebraska; Douglas Electric Co-operative, 15 miles in Oakland County, Oregon; Waushara County Electric Co-operative, 290.8 miles in Waushara County, Wisconsin; Pella Co-operative Electric Assn., 53 miles in Marion County, Iowa; P. K. M. Electric Co-operative, 140 miles in Marshall County, Minnesota; Prince William Electric Co-operative, 72 miles in Prince William County, Virginia.

Also, Crow Wing Co-operative Power & Light, 16.4 miles in Crow Wing County, Minnesota; Buckeye Rural Electric Co-operative, 124.2 miles in Gallia County, Ohio; Adams Rural Electric Co-operative, 97.9 miles in Adams County, Ohio; Harrison Rural Electric Assn., 93.79 miles in Harrison County, West Virginia; Paulding-Putnam Electric Co-operative, 39.7 miles in Paulding County, Ohio; Accomack-Northampton Electric Co-operative, 108 miles in Northampton County, Virginia; South Kentucky Rural Electric Co-operative, 73 miles in Wayne County, Kentucky; North Alabama Electric Co-operative, 88.6 miles in Jackson County, Alabama.

Also, Sand Mountain Electric Co-operative, 132 miles in DeKalb County, Alabama; Jackson County Rural Electric Co-operative, 152.4 miles in Jackson County, Kentucky; Northern Electric Co-operative Assn., 14 miles in St. Louis County, Minnesota; Traverse Electric Co-operative, 15.5 miles in Traverse County, Minnesota; Southern Illinois Electric Co-operative, 65 miles in Pulaski County, Illinois; West River Electric Co-operative, 60.5 miles in Pennington County, South Dakota; Columbia County Rural Electric Co-operative, 64 miles in Columbia County, Washington; Northeast Nebraska Rural Public Power District, 114 miles in Nebraska County, Nebraska; Norris Rural Public Power District, North County, Nebraska.

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## E.E.I. to Hold Annual Meeting in New York

Edison Electric Institute has announced that it will hold its annual meeting on Thursday and Friday, June 3 and 4, at the Waldorf-Astoria Hotel in New York. A preliminary program covering the sessions is now being formulated. A meeting of the operating committee is scheduled for June 2 and will be held at the same location.

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## Wholesalers to Hold Buffalo War Conference

The National Electrical Wholesalers Association will hold an industry war conference at Buffalo, May 25 and 26, at which the principal speaker will be William L. Batt, vice-chairman of the War Production Board, according to a recent announcement by Charles G. Pyle, managing director of the association.

## MEETINGS

**Edison Electric Institute**—Annual meeting, Waldorf Astoria Hotel, New York, N. Y., June 2-4. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

**Previously Listed**

**National Electrical Manufacturers Association**—Spring meeting, Palmer House, Chicago, Ill., April 20-23. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

**North Central Electrical Industries** — Annual all-industry conference, Radison Hotel, Minneapolis, Minn., April 26-27. Wm. A. Ritt, secretary-manager, Foshay Tower, Minneapolis, Minn.

**American Society of Mechanical Engineers**—Spring meeting, Hotel Black Hawk, Davenport, Iowa, April 26-28; semi-annual meeting, Hotel Biltmore, Los Angeles, Calif., June 14-16. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

**Edison Electric Institute** — Spring conference of utility accountants, AGA-EEI, Netherland Plaza Hotel, Cincinnati, Ohio, April 27-28; general commercial meetings, Edgewater Beach Hotel, Chicago, Ill., April 29-30; transmission and distribution committee, Edgewater Beach Hotel, Chicago, Ill., May 10-11; accident prevention committee, Edgewater Beach Hotel, Chicago, Ill., May 12-13. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

**Missouri Valley Electric Association**—Annual engineering conference to be held in conjunction with meeting of 7th District American Institute of Electrical Engineers, Continental Hotel, Kansas City, Mo., April 28-30. I. D. Pettegrew, director, 1527 Sharp Bldg., Lincoln Neb.

**American Institute of Electrical Engineers**—Southwestern District, Kansas City, Mo., April 28-30; National Technical Meeting, Cleveland, Ohio, June 21-25. H. H. Henline, national secretary, 33 W. 39th St., New York.

**Pennsylvania Electric Association**—Systems operation committee, Hotel Brunswick, Lancaster, Pa., May 6-7; E. W. Middleton, chairman, Pennsylvania Power & Light Co., Hazleton, Pa. Electrical equipment committee, Altoona, Pa., May 20-21; A. N. Shealy, chairman, Pennsylvania Water & Power Co., Baltimore, Md.

**Association of Iron and Steel Engineers**—Spring conference, William Penn Hotel, Pittsburgh, Pa., May 10. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

**Arkansas Utilities Association** — Annual convention, Marion Hotel, Little Rock, Ark., May 10-11. R. E. Ritchie, secretary, P. O. Box 551, Little Rock, Ark.

**National Fire Protection Association** — Annual meeting, Palmer House, Chicago, Ill., May 10-14. R. S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

**National Electrical Wholesalers Association**—War conference, Hotel Statler, Buffalo, N. Y., May 24-26. Alfred Byers, secretary, 165 Broadway, New York, N. Y.

**Illuminating Engineering Society** — Great Lakes regional conference, Rackham Memorial Bldg., Detroit, Mich., June 5. G. R. Baumgartner, regional vice-president, General Electric Co., Nela Park, Cleveland, Ohio.

**National District Heating Association** — Annual meeting, Hotel Schenley, Pittsburgh, Pa., June 9-10. John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Ave., Pittsburgh, Pa.

**Canadian Electrical Association**—Annual meeting, Seigniory Club, Quebec, June 17-18. B. C. Fairchilds, secretary, 804 Tramways Bldg., Montreal, Que.

**Society for Promotion of Engineering Education**—Annual meeting, Illinois Institute of Technology, Chicago, Ill., and Northwestern University, Evanston, Ill., June 18-20. F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa.

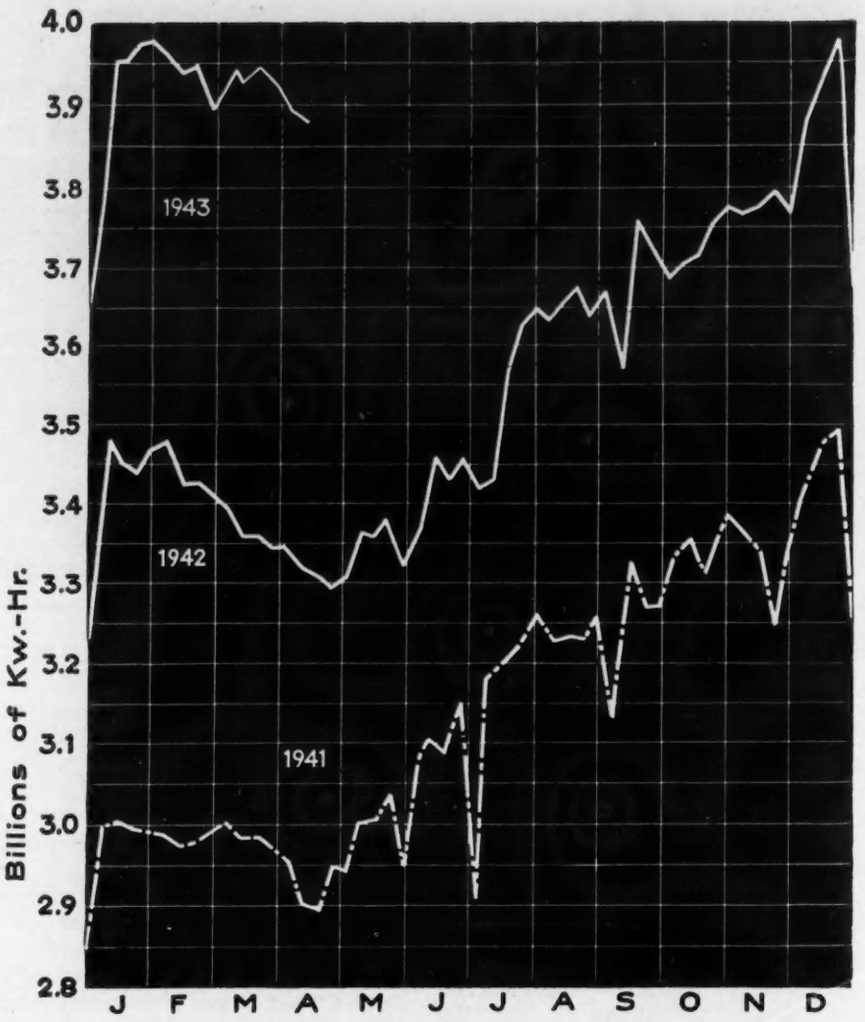
**American Society for Testing Materials**—Annual meeting, Pittsburgh, Pa., June 28-July 1. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

## Output Again Declines Slightly

The output curve registered another slight seasonal decline during the week ended April 10. The amount of electrical energy distributed by the light and power industry totaled 3,882,467,000 kw.-hr., as compared to a total of 3,889,858,000 kw.-hr. for the week ended April 3 and 3,928,170,000 kw.-hr. for the week of March 27, according to the Edison Electric Institute. Figures for the latest week represent a 16.9 percent increase over the corresponding week in 1942—a slight gain from the 16.2 percent increase registered the previous week.

Among the seven major geographic divisions of the country, the Mid-Atlantic, Central Industrial, West Central and Pacific Coast areas increased their percentage gains over the 1942 week, compared to the previous week's tally; the New England, Southern States and Rocky Mountain districts lost ground.

The Pacific Coast area, with 26.9 percent increase over the 1942 week, continued to lead the country in output gains, with the Southern states, at 19.7, a close second.




**Weekly Output, Millions Kw.-Hr.**

| 1943 | | 1942 | | 1941 | |
|---|---|---|---|---|---|
| Apr. 10 | 3,882 | Apr. 11 | 3,321 | Apr. 12 | 2,905 |
| Apr. 3 | 3,890 | Apr. 4 | 3,348 | Apr. 5 | 2,959 |
| Mar. 27 | 3,928 | Mar. 28 | 3,345 | Mar. 29 | 2,975 |
| Mar. 20 | 3,947 | Mar. 21 | 3,357 | Mar. 22 | 2,983 |
| Mar. 13 | 3,945 | Mar. 14 | 3,357 | Mar. 15 | 2,983 |
| Mar. 6 | 3,947 | Mar. 7 | 3,392 | Mar. 8 | 3,005 |
| Feb. 27 | 3,893 | Feb. 28 | 3,410 | Mar. 1 | 2,993 |
| Feb. 20 | 3,949 | Feb. 21 | 3,423 | Feb. 22 | 2,985 |
| Feb. 13 | 3,940 | Feb. 14 | 3,422 | Feb. 15 | 2,976 |
| Feb. 6 | 3,960 | Feb. 7 | 3,475 | Feb. 8 | 2,989 |

**Percent Change from Previous Year**

| | Week Ending | | |
|---|---|---|---|
| | Apr. 10 | Apr. 3 | Mar. 27 |
| New England | + 9.4 | +10.0 | + 7.5 |
| Mid-Atlantic | +15.3 | +13.1 | +12.5 |
| Central Industrial | +15.0 | +13.1 | +14.8 |
| West Central | +12.4 | +11.0 | +14.2 |
| Southern States | +19.7 | +22.5 | +25.4 |
| Rocky Mountain | +10.6 | +12.3 | +12.2 |
| Pacific Coast | +26.9 | +24.4 | +26.3 |
| Total United States | +16.9 | +16.2 | +17.4 |

## Energy Sales Advance 15.5% in December

Sales of electric energy to ultimate consumers in December totaled 14,746,719,000 kw.-hr., compared with 12,768,153,000 kw.-hr. in December, 1941, an increase of 15.5 percent, according to the report issued by the Edison Electric Institute.

Of a total generation of 17,681,200,000 kw.-hr. for December, generation by water power plants accounted for 6,109,800,000 kw.-hr., a gain of 35.9 percent over the water power total for December, 1941.

Revenue from ultimate customers amounted to $255,710,600 in December, compared with $239,610,500 for the similar month of 1941, an increase of 6.7 percent.

For the twelve months ended December 31 the average annual use advanced to 1,022 kw.-hr. per customer from 986 for the similar period of 1941; average annual bill to $37.51 from $36.78; revenue per kilowatt-hour dropped to 3.67 cents from 3.73 cents for the twelve months ended December 31, 1941.

**Classification of Sales, December, 1942 and Change from 1941**

| Kilowatt-hour sales— During month of December | Million Kw.-Hr. 1942 | 1941 | % Change |
|---|---|---|---|
| Residential or domestic | 2,522 | 2,393 | +5.4 |
| Rural (distinct rural rates) | 187 | 148 | +26.6 |
| Commercial or industrial | | | |
| Small light & power | 2,366 | 2,189 | +3.3 |
| Large light & power | 8,188 | 6,882 | +20.8 |
| Street & highway lighting | 216 | 224 | —3.5 |
| Other public authorities | 439 | 301 | +45.8 |
| Railways and railroads | | | |
| Street & interurban | 444 | 369 | +20.6 |
| Electrified steam | 227 | 200 | +13.2 |
| Interdepartmental | 158 | 63 | +149.1 |
| Total to ult. customers | 14,747 | 12,768 | +15.5 |

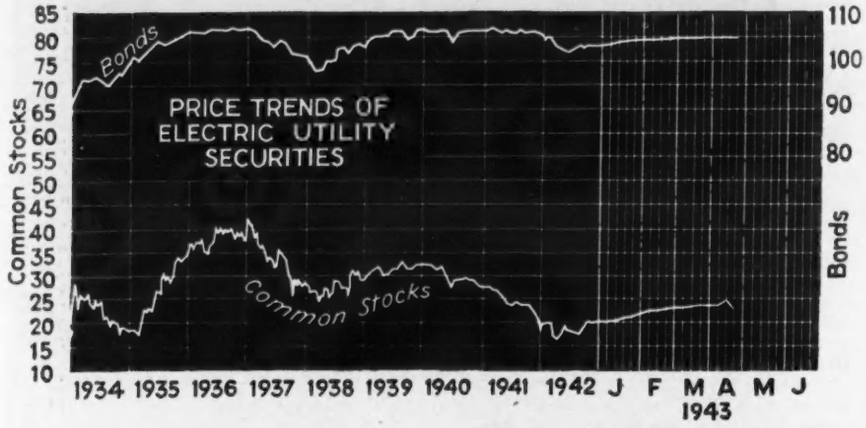
## TVA Employees Included in Confirmation Bill

The Senate judiciary committee reversed itself last week to include employees of the Tennessee Valley Authority under provisions of a bill requiring that federal employees who earn more than $4,500 a year be confirmed by the Senate.

While considering the bill previously, the committee had accepted an amendment by Sen. Carl Hatch, Arizona Democrat, which would have exempted the TVA employees.

The reversal followed a fight by Sen. Kenneth McKellar, Tennessee Democrat, and long-time foe of TVA, to junk the Hatch amendment. McKellar led the opposition to the Hatch amendment during a three-hour executive session of the committee. Previously, the committee had approved the bill, with the Hatch amendment.

## Utility Stock and Bond Prices Decline




**During the past week electric light and power stocks lost the ground they had gained the previous week. "Electrical World" index dropped to 23.5 from 24.3; last year, 17.3. Bonds changed only slightly, the index dropping to 105.1 from 105.2; last year, 102.3**

## "Death Sentence" Brief is Filed

### *North American's Challenge to SEC in Supreme Court Hands*

The first round in the fight over the constitutionality of the "death sentence" provisions of the Holding Company Act took place recently when the North American Co. filed a brief with the U. S. Supreme Court assailing the "destructive" provisions of the act and challenging the Securities and Exchange Commission order requiring North American to divest itself of all its properties and investments except the Union Electric Co. of Missouri. The SEC's order has already been upheld by the U. S. Circuit Court of Appeals and oral argument before the high court was expected to be under way this week.

#### *Destruction of Values Charged*

North American's brief, filed by Charles Evans Hughes, Jr., counsel for the utility, asserted ordering the holding company to divest itself of all its assets except one property "will inevitably involve a vast destruction of values."

"First and paramount," the brief said, "is the destruction of the right of shareholders to pool their investments and thereby obtain for them the benefits of efficient, common management of diversified interests. That right is one conferred by the state of New Jersey, which has authorized persons to form corporations in order to acquire and hold stocks of other companies. The North American Co. represents one of the early exercises of that right. It was organized in 1890 and its 53 years of history shows how valuable that right has been.

"The North American Co. has steadily grown and prospered and it has done so through being a prudent and wise investor. The record of this case is replete with evidence showing the beneficent influence of the North American Co. management upon the properties in which it has largely invested. The management has promoted efficient local managements. It has provided them with the financial resources for sound development and has promoted operating efficiency through encouraging the operating companies to exchange the benefits of their experience. . ."

The brief further argued that if Section 11 (b) (1)—the geographic integration phase—of the act is constitutional, and the size and number of properties which a utility company may retain can be specifically limited, then "Congress would equally be authorized to fix the number of factories that an industrial concern might be permitted to have or the number of branch stores that a mercantile establishment might maintain. . ."

The brief pointed out, too, that enforced large-scale liquidation in wartime, under depressed market conditions and the disappearance of security purchasing demands and power, means "the maximum in sacrifice."

•

## SEC Approves Sale of Texas Water Properties

The SEC has approved the sale of the water and irrigation properties owned by Texas Public Service Co., a subsidiary of Peoples Light & Power Co., to the Lower Neches Authority for approximately $3,055,000 in cash. Jurisdiction over the proceeds of the sale was reserved by the commission.

•

## Cut in 1944 REA Budget Is Urged

The subcommittee on agriculture of the House appropriations committee has recommended a cut of $425,000 in the budget estimates for the Rural Electrification Administration for the fiscal year of 1944. Under the bill REA would be allowed $2,258,000 for administrative expenses and $20,000,000 credit for loans. The latter figure represents a $10,000,000 cut in budget estimates.

Reductions were based on the fact that "many phases of the work of this agency have been brought to a virtual standstill because of the war and the resulting non-availability of critical materials for new construction."

The loan authorization, if approved as submitted by the committee, would give REA about half as much money for loans as it had last year, when its appropriation of $10,000,000 was augmented by approximately $30,000,000 of carry-over funds. Much of the loan authorization for fiscal 1944 is expected to be applied to farm line construction under order U-1-C.

•

## Rejects PPD Purchase

Voters at Kearney, Neb., on April 6 rejected a proposal to issue $310,000 in bonds to purchase the distribution system of the Consumers Public Power District there through condemnation. A condemnation court had fixed the value of the property at $271,000 plus $5,975 for motor vehicles and fixtures. An additional $25,000 was to be paid in ten years if the city did not purchase energy from the Consumers.

## Utility Reports

| | Net Income 1943 | 1942 |
|---|---|---|
| *Arkansas Power & Light | $1,176,778 | $2,031,187 |
| *Central Maine Power and sub | 3,421,771 | 3,436,932 |
| *Central States Electric | 140,450 | 110,456 |
| *Dallas Power & Light | 1,489,140 | 1,806,830 |
| †Engineers Public Service and subs | 4,214,289 | 4,659,455 |
| *Idaho Power | 1,388,788 | 1,209,946 |
| *Indiana Service | 458,927 | 451,079 |
| *Iowa Elec. Light & Power | 760,573 | 753,561 |
| *Louisiana Power & Light | 1,290,230 | 1,141,873 |
| *Mississippi Power & Light | 721,715 | 533,401 |
| *New Orleans Public Service | 2,179,260 | 2,547,707 |
| *Tampa Electric | 1,154,760 | 1,185,179 |

* Twelve months ended February 28.
† Twelve months ended January 31.

# The RIGHT Instruments Help Get the Jump on TROUBLE

## How Would You Handle these 3 Jobs?

**1** **MOTOR LOAD** is being analyzed with a G-E portable inkless recorder. The test is made *without interrupting production,* simply by using a split-core current transformer (clamped around a lead in the control cabinet) connected to the recording ammeter.

**2** **FEEDER CIRCUITS** are being checked with the G-E hook-on volt-ammeter. Both current and voltage are measured with just *one* instrument, simply by flicking the selector switch, first to AMPS and then to VOLTS.

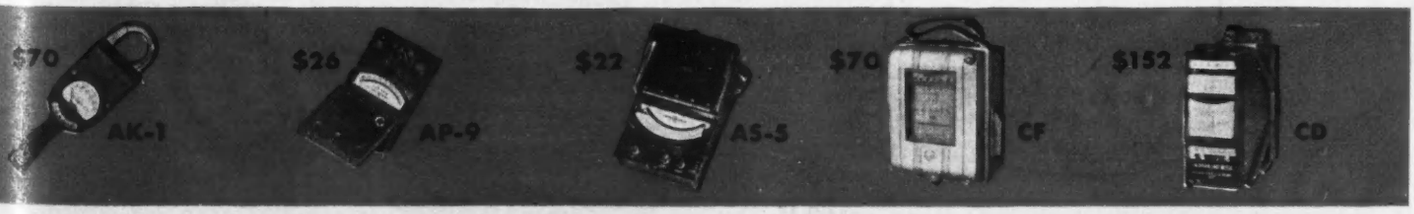
**3** **MOTOR-STARTING CURRENT** is being determined quickly by means of a G-E pointer-stop ammeter. An oscillograph could be used, but it is easier to use this instrument—particularly when there are a large number of motors to be checked.

These are typical examples of using the RIGHT instrument to get electric-circuit information in a hurry, without interrupting production. Have you the RIGHT ones for your preventive maintenance? This is particularly important if you have green hands in your maintenance department.

### 5 Instruments Will Do 90% of Most Testing Jobs

The G-E instruments shown below will handle most of your testing. Prices are for estimating only. For details, ask the nearest G-E office for the bulletins listed. If you need other instruments, let us know. *General Electric, Schenectady, N. Y.*

### WHICH OF THESE TESTING INSTRUMENTS DO YOU LACK?




**A-C HOOK-ON VOLT-AMMETER.** The handiest of instruments for quick load checks—no cutting conductors or interrupting service. Measures volts and amps. Bulletin GEA-2950.

**MEDIUM-SIZE PORTABLE, A-C (AND DP-9, D-C).** Accurate within ¾ of one per cent. Very portable—size only 2½ by 4¾ by 6½ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

**POCKET-SIZE PORTABLE, A-C (AND DS-5, D-C).** Accurate within one per cent. Slips easily into a coat pocket—size 2 by 3½ by 5½ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

**INKLESS RECORDER, PORTABLE.** An inexpensive instrument. Inkless—no pen to start and no ink to spill. Price covers a 5/10-amp ammeter. Bulletin GEA-3187.

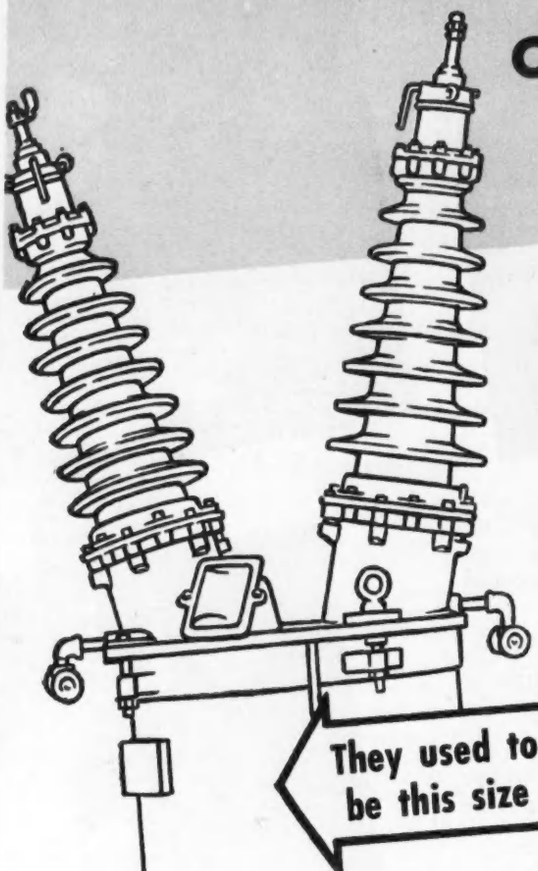
**INK RECORDER, PORTABLE AND SWITCHBOARD.** Ideal for use where a high degree of accuracy is very important. Price covers a 5-amp portable ammeter. Bulletin GEA-1061.

# GENERAL ELECTRIC

602-42-6200

# *For the First Time*

## A COMPLETE LINE OF SMALL-SIZE OUTDOOR INSTRUMENT TRANSFORMERS



They used to be this size

Type E-116
69 kv

HERE ARE YOUR *NEW* SMALL-SIZE TWO-BUSHING TRANSFORMERS

POTENTIAL

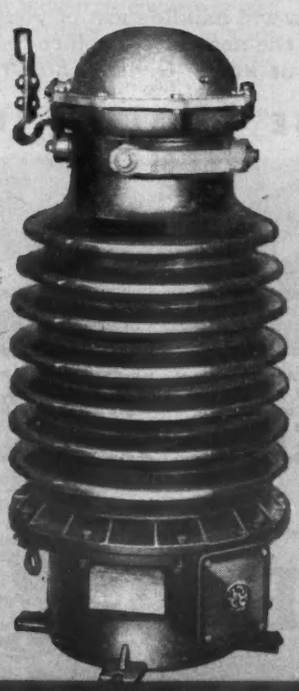
Type E-236
24 to 69 kv

Now they're this size

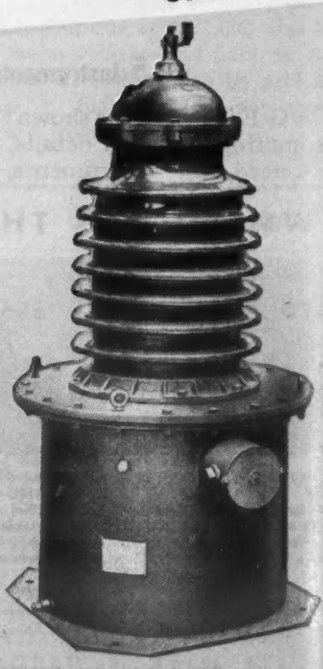
69 kv

| | | |
|---|---|---|
| 108 in. | Height | 55 1/2 in. |
| 26 1/4 in. | Width of base | 28 1/2 in. |
| 125 gal | Liquid volume | 20 gal |
| 2400 lb | Net weight | 1000 lb |

AND HERE ARE THE COMPANION SMALL-SIZE G-E TRANSFORMERS THAT WERE ALREADY AVAILABLE



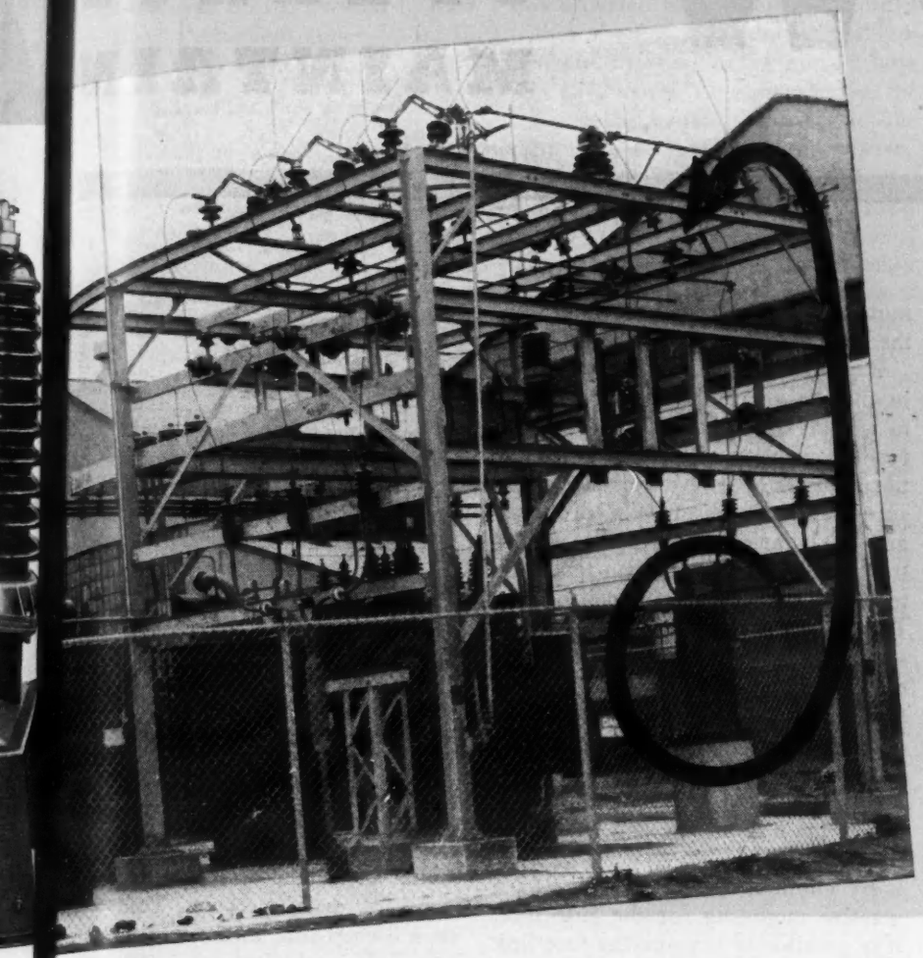
Current transformers



Single-bushing potential transformers

# ow You Can Mount Them All up in the Structure

## *and get these advantages*



### SAVE SPACE

The small size and light weight of these G-E transformers make it possible to mount them up in the structure and save valuable ground space.

### SIMPLIFY CONNECTIONS

Mounting in the structure simplifies primary (high-voltage) connections.

New structures can be designed to take full advantage of the small size and light weight of these units, and transformers can be installed in existent structures without building a separate foundation. You don't need to consider the testing or inspecting of the insulating liquid, because it is sealed in—thus reducing maintenance.

### CHARACTERISTICS

Both accuracy and insulation characteristics have been maintained in spite of the reduction in size and weight.

ACCURACY—These transformers meet the highest accuracy classification, and are suitable for either metering or relaying.

| | |
|---|---|
| Current transformers | ¼X, ¼Y, ¼ Z |
| Single-bushing potential transformers | ¼W, ¼X, ¼Y, ¼Z |
| Two-bushing potential transformers | ¼W, ¼X, ¼Y, ¼Z |

INSULATION—Ample insulation is provided to meet the ASA standards on both impulse and low-frequency tests.

### FOR THE "LAST OUNCE" OF PROTECTION SPECIFY PYRANOL*

You can order these transformers filled with either Pyranol or oil. BUT, because instrument transformers are such a vital link in the protection of your system; you'll undoubtedly want Pyranol—the G-E insulating and cooling liquid which is chemically stable. It means greater safety, too. It is noninflammable.

*Reg. U.S. Pat. Off.

### YOU'LL FIND IT IN THE G-E LINE

In addition to these outdoor units, General Electric makes a complete line of indoor current and potential types, and portables. You can adopt G-E instrument transformers as standard for your system.

If you'd like information about a specific type of transformer, we'll be glad to send you complete data. If you'd like to discuss the application of these transformers to a specific metering or relaying job, the meter specialist in the nearest G-E office will be glad to work with you. *General Electric, Schenectady, N. Y.*

The Army-Navy "E", for Excellence in the manufacture of war equipment, now flies over six G-E plants employing 100,000 men and women.

GENERAL ELECTRIC

# HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

## Material Conservation in Fuse Switch Design

By L. L. CRUMP*
Vice-President and Chief Engineer
James R. Kearney Corporation, St. Louis

Conventional design of an expulsion fuse switch consists of a bakelite tube lined with fibre closed at one end and hinged in a mounting in such a manner that the cartridge can be removed to insert a new fuse after a fuse link has blown. On heavy short circuits mechanical reaction results from the blowing of a fuse link. The wall thickness of the fuse link holder or tube must be heavy enough to prevent the tube from bursting, and the fiber liner must be of sufficient thickness in order to continue to be effective, even after a relatively large number of fuse links have blown in the cartridge.

By contrast, the fundamental idea in the design of the Trip-O-Link is to so arrange the relation of the fusible element with respect to the fibre tube as to relieve excessive pressure before it becomes a problem, and to balance the pressure within the tube so that there is no tendency to propel the tube in either direction. This is done by arranging the fusible section of the fuse link at the center of a tube open at both ends, so that the gases may be exhausted at both ends with equal force. Also to design the size and length of the tube bore, so as to obtain the maximum efficiency for a given size and voltage of fuse link.

By eliminating the necessity of a massive mounting for the fuse link, it is possible to support the fuse link between two resilient lightweight Copperweld members. Having eliminated the mechanical destructive force, it is also feasible to use a much lighter porcelain support. In the 50-amp., 7,500-volt Trip-O-Link (Fig. 1) the saving in weight of critical material is 5¾ lb., or 53 percent. Test made on a 34,500-volt unit, using 50-amp. fuse link, and clearing 3,840 amp., gave oscillograph records (Fig. 2) of five shots which cleared satisfactorily with no damage to the equipment; the short circuit was cleared in less than one cycle on all shots.

* Excerpted from recent talk of conservation session of Power Group A.I.E.E. New York Section.

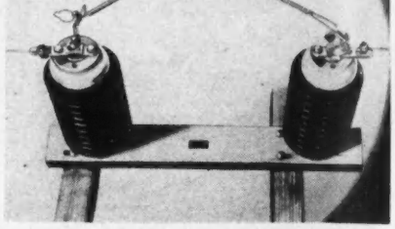


FIG. 1—Trip-O-Link fuse switch has balanced forces and conserves materials

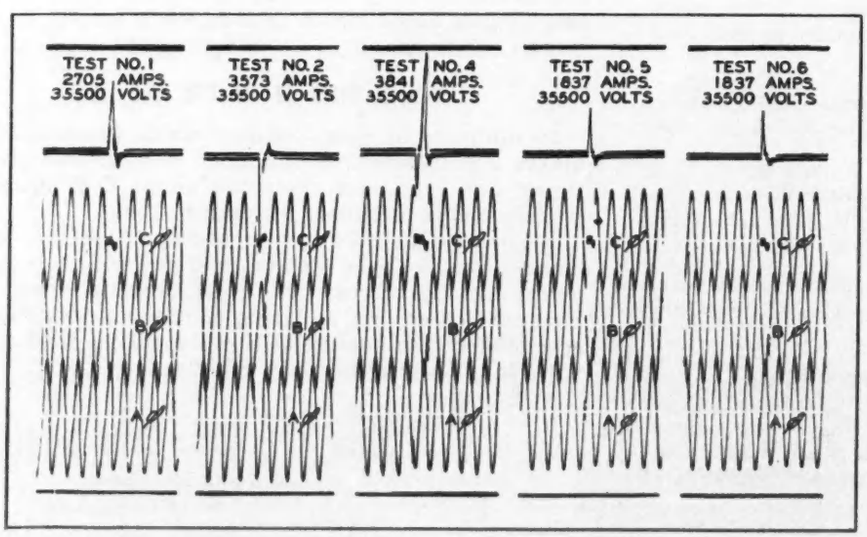



FIG. 2—34.5-kv. unit with 50-amp. link interrupts up to 3,840 amp. in less than one cycle

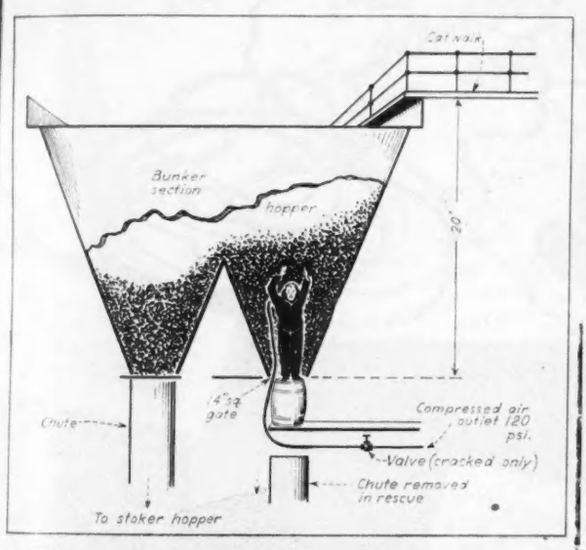
## Method of Rescuing Coal Operator

Early application of low-pressure air through a hose line, careful removal of fuel with the aid of a species of wooden cofferdam and other factors utilized to advantage by a well-directed rescue crew saved the life of Domenico Rachele (age 63, weight 190 lb., height about 5 ft. 6 in.) when he was recently buried under 5 ft. of coal for several hours at the State Street steam plant of the Western Massachusetts Electric Com-

pany in Springfield. The operating lessons of this episode are instructive, the accident was caused by failure to observe posted regulations requiring every employee of the station leaving the catwalk above the boilers in order to step upon coal in a bunker or hopper to be roped with a second man on the catwalk to tend the line. Permanent ropes ¾ in. in diameter are located here.

### *Under Five Feet of Coal*

To break up a bridging or arching condition in the chute below one of the bunkers, Rachele (employed in the plant 26 years) climbed through a guard rail and dropped down on top of the coal surface. Holding to the rail he jumped up and down without dislodging the coal, although warned by his helper that he should be roped. As he reached to take a bar from the catwalk, the coal gave way and went to the chute with a rush, taking him with it. He was buried under about 5 ft. of Pennsylvania bituminous coal, wearing a heavy sheepskin coat with collar turned up. His felt hat was knocked off, but his glasses remained in place during the rescue period.




**RESCUE of employee buried in coal bunker**

From the catwalk to the hopper gate (14 in. square) was about 20 ft., and the hopper gate was about 25 ft. above the stoker hopper below. The helper immediately reported the accident to P. Vogler, chief steam engineer of the station, and W. D. Packard, superintendent of stations, Springfield division, W. M. E. Company. From the bunkers it was difficult to tell where the victim was, but it appeared probable that he was in bunker No. 5, and a crew immediately broke the coal chute under it so that a prod could be pushed up into it from the bottom. The victim's feet could be seen in the open gate of the hopper. Within seven minutes of the alarm a rubber hose was attached to a 120-psi. air outlet within about 8 ft. of the hopper bottom and inserted in the bunker hopper sufficiently to deliver air (the valve being merely cracked) to the victim's face. This air supply resuscitated him sufficiently to result in responses to pinching his legs. A crew then started to shovel out the coal with extreme care from the bunker into adjacent bunkers and after about three hours it became possible to talk through the coal layer to the victim. A bar had been driven carefully behind his back and his feet and legs were relieved by blocking them up with a barrel on a wooden platform. Complications ensued, however, when the coal remaining in the bunker again slid down and covered the victim. A wooden box or cofferdam about 6 ft. square by 6 ft. deep, without top or bottom, was quickly built in the plant carpenter shop of 2x12-in. planks and carried to the hopper complete lest nailing it on the site of the accident might dislodge still more coal. Shovelers with scoops were then put inside the box to throw out coal, and more planks set around the box as the coal built up outside it. The victim's head was reached in about two hours more, and shortly afterward, obeying instructions to stiffen his body when the men below moved his feet, he was hauled up with a rope, taken up the permanent ladder within the bunker and removed to a hospital on a stretcher. While suffering from the shock and a bruise on the jaw, the victim sustained no broken bones or injuries of consequence, sitting up and eating a hearty breakfast the next day. The heavy coat and upturned collar played an important part in padding the victim against crushing and suffocation, the compressed air line being a vital element in rescue.

# Performance of Δ — Δ Transformer Banks

## I—Single-Phase Load

By ROBERT S. SARGENT
Associate Engineer,
U. S. Engineering Office, Jacksonville, Fla.

A single-phase load on a delta-delta transformer bank will divide at the transformers inversely as the impedances of the transformers, with part of the current flowing in the windings of the transformer across the phases of which it is connected, and the remaining part flowing in the two windings (in series) of the two other transformers. If it is assumed that the bank consists of a middle transformer and two wing transformers, the wing transformers being identical with each other and never larger than the middle transformer, and if it is assumed that the transformers have the same percent impedance and the same resistance-reactance ratio, then the single-phase loan will divide as follows:

Load on middle transformer equals the single-phase load multiplied by $\frac{2A}{B+2A}$, and the load on each wing transformer equals the single-phase load multiplied by $\frac{B}{B+2A}$,

$A$ being the kva capacity of the middle transformer and $B$ being the kva capacity of each wing transformer.

The following conclusions can be drawn from the formulas:

1. If the three transformers are equal in size, then the middle transformer will carry two-thirds of the single-phase load and each wing transformer one-third. The formulas are thus identical with those applicable to a wye-delta bank with floating primary neutral.

2. As the wing transformers are made smaller, the middle transformer assumes more and more of the load and the wing transformers less and less. The practical consequence of this is that it is impossible to overload the wing transformers with a single-phase load, or, more accurately, impossible to overload them without overloading the middle transformer first. For example, assume a 100-kva. load on a 100-kva and two 1½-kva. transformers. Load on the 100 would equal 99.3, load on each 1½ would equal 0.75. In order to load the 1½'s to capacity, the load would have to be increased to 200 kva., at which point the middle transformer would be carrying 199 kva.

Discussions relative to perform-

FOR CORROSIVE LOCATIONS. These oil-immersed combinations are made in two forms —for both corrosive and hazardous locations.
DUST-TIGHT COMBINATIONS. Available through NEMA size 5—these starters are for application in dusty locations
NEW HIGH-VOLTAGE COMBINATION. This provides split-cycle short-circuit protection and starting means for high-voltage motors.

# GENERAL ELECTRIC

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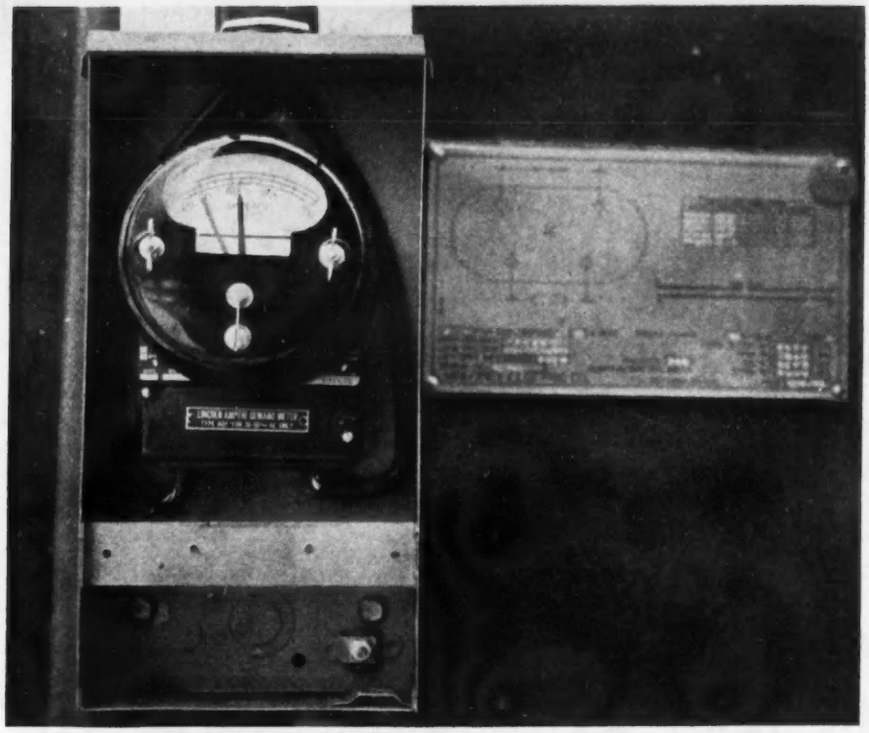
HEY BILL!
YOU'RE DOUBLING YOUR WORK WHEN YOU INSTALL CONTROL THAT WAY!
EVER HEAR OF G-E COMBINATION MOTOR STARTERS?
By using G-E combination starters, you can cut the time required to install motor control by 50 per cent. That's because "combinations" combine two controls—a motor-circuit switch (with short-circuit protection) and a magnetic starter—in one, compact, easy-to-mount unit.
But that isn't all—combination starters save critical material by eliminating unnecessary conduit; and they offer your operators better protection because the case door is interlocked with the safety switch.
Save man-hours and critical material by specifying General Electric combination starters. General Electric Company, Schenectady, N. Y.
WATERTIGHT COMBINATIONS For outdoor application and for installation in damp locations.
FOR HAZARDOUS LOCATIONS Enclosed in a high-strength, alloy case, these starters are ideal for Class 1, Group D, locations.
FOR GENERAL-PURPOSE USE These combinations are for indoor applications where atmospheric conditions are normal.
MBINATION STARTERS FOR MOTORS FROM 1 TO 1000 HP



**THERMAL ampere demand meters on individual transformers of 1,500 kva. banks indicate maximum half-hour peak loads**

ance with a balanced three-phase load, also a combined single-phase and three-phase load, will be presented in subsequent issues.

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## Demand Meters Guide Bank Loading

Thermal-type half-hour ampere demand meters, mounted on individual transformers of delta-wye-connected 33/12.5-kv. transformer banks at principal distribution substations of an Indiana utility are used to indicate maximum sustained loads carried. On the basis of data so obtained banks are "changed out" as they become overloaded.

In each transformer the ampere demand meter is connected directly in the secondary lead to the grounded neutral of the wye connection, without instrument transformers. In the case of 1,500-kva. banks meters with a full scale capacity of 100 amp. are used.

Thermal lag of the instruments used is such that a 100 percent reading is obtained for peak loads of one-half hour duration; approximately 90 percent reading is obtained for peaks of 15-minute duration. Most significant peak loads on distribution systems will hold for at least a half hour. For this reason half-hour thermal ampere demand instruments were considered desirable for this application since the thermal lag of the instrument corresponds approximately to the thermal response of the transformer itself under various load conditions.

Instruments are mounted, as shown, in conventional type metal meter boxes fastened to the transformer case or clamped by U-bolts to the transformer radiator tubes.

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## Boost C.T. Ratios on Spray-Cooled Banks

As steps are taken to increase the overload capacity of substation power transformers by forced cooling, to meet emergency conditions, current transformers should come in for their share of attention. Also, the range of station ammeters should be checked. Such checks will insure that emergency current can be read on station instruments when the time comes and that currents within the range for the differential protection can be accurately determined. Oil circuit breaker and disconnect switch capacity should also be investigated.

Such a survey was made recently by engineers of the Wisconsin Electric Power Company when water spray cooling facilities were added to transformers in certain Milwaukee substations. As a result some changes were made to increase the ratio of instrument current transformers on both high- and low-voltage sides of the affected banks. Breaker and switch capacity was found adequate.

The accompanying table indicates the normal full-load current and current transformer ratios that existed before spray cooling was provided; it indicates the load current at 133 percent of rating and shows the changes that were made in current transformer ratios. The table covers four 3,000-kva., 26,400/2,300/4,000-volt, delta-wye connected transformer banks out of several that were surveyed; however, it is typical of the survey findings.

It will be noted that in the case of banks 1 and 2 no change was made in the high-voltage current transformer ratio. In these cases the only change necessary was in the ratio of the current balancing auto-transformers that adjust for the differences in performance or small differences in ratio of instrument current transformers on the high and low sides of the bank, thus effecting an exact ratio balance between the currents in the two circuits of the differential system.

**Changes in Current Transformers with Forced Cooling of Transformers**

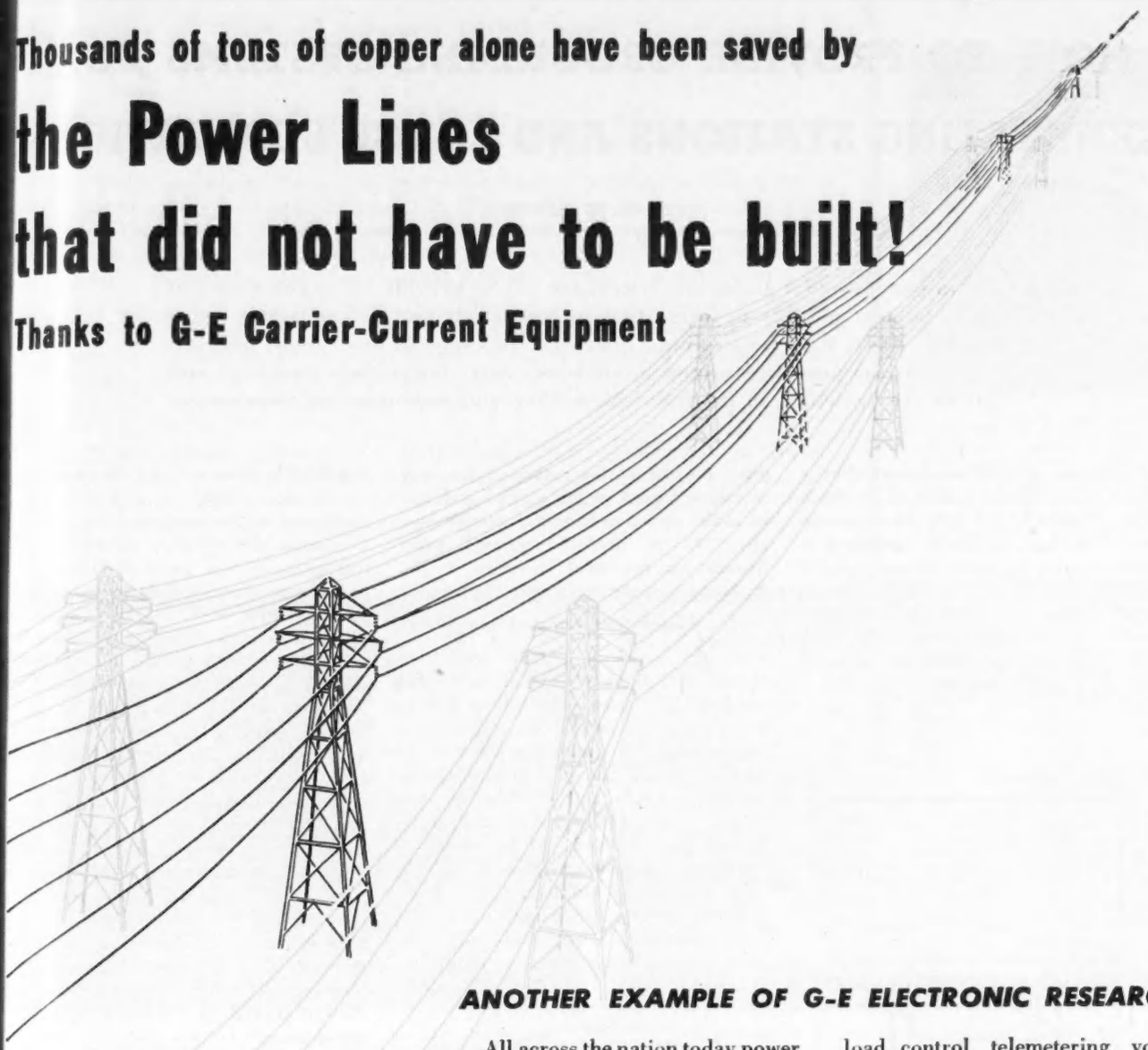
| Bank | Kva. Capacity | Voltage | Present C. T. Ratio | 100% Load Amp. | Proposed C. T. Ratio | 133% Load Amp. | New I in % of Old C. T. Ratio | Differential Relay Type |
|---|---|---|---|---|---|---|---|---|
| 1 | 3,000 | 26,400 to 2,300/4,000 | *60/5 | 38 | No change | 50.7 | 84.5 | PF-3 |
| | | | 500/5 | 434 | 600/5 | 578 | 115.5 | |
| 2 | 3,000 | Same | *60/5 | 38 | No change | 50.7 | 84.5 | PF-3 |
| | | | 500/5 | 434 | 600/5 | 578 | 115.5 | |
| 3 | 3,000 | Same | 80/5 | 65.5 | 100/5 | 87.2 | 109 | CO |
| | | | 500/5 | 434 | 600/5 | 578 | 115.5 | |
| 4 | 3,000 | Same | 75/5 | 65.5 | 100/5 | 87.2 | 116.2 | CO |
| | | | 500/5 | 434 | 600/5 | 578 | 115.5 | |

* Current transformer connected inside delta on high-tension side.

## Thousands of tons of copper alone have been saved by

# the Power Lines that did not have to be built!

## Thanks to G-E Carrier-Current Equipment



### *ANOTHER EXAMPLE OF G-E ELECTRONIC RESEARCH*

All across the nation today power is being delivered from *invisible* transmission lines. Kilowatts for airplane factories, arsenals, aluminum plants — in short, for war!

These phantom power lines are the ones that *did not have to be built* out of critically needed copper, steel, aluminum, insulation.

*Carrier current made them possible!*

New power lines and pilot lines are almost impossible to obtain today. Nor are they necessary, with G-E carrier current!

Today's G-E carrier-current equipment, backed by 20 years of research and improvement, is permitting existing power lines to deliver more kilowatts for war by means of pilot relaying, automatic load control, telemetering, voice communication, to name a few.

Carrier current, superimposed on the power lines, permits increased interconnections between companies, many new war loads on major transmission lines without loss of stability as loads go up.

The average carrier-current installation saves thousands of tons of copper and steel for every pound of these vital materials it uses. Comparable savings in other materials, and in critical wartime manpower for installation, maintenance, and patrolling, are the rule!

G-E carrier-current engineers welcome your inquiries, will be glad to make surveys, recommendations. . . . *Electronics Department, General Electric, Schenectady, N.Y.*

**GENERAL ELECTRIC**

151-81-6920

# HOW TO PROVIDE GROUNDING SYSTEMS FOR GENERATING STATIONS AND LARGE SUBSTATIONS

By W. W. LEWIS
Central Station Engineering Department, General Electric Company, Schenectady, N. Y.

**Main purposes of a grounding system are (1) to provide safety for operators and attendants and (2) to insure that in general all parts of apparatus, other than live parts, shall be at ground potential. In order to meet those purposes suggestions for providing proper grounds in generating stations and large substations are presented in the following outline and accompanying illustrations.**

A common ground bus surrounding a station should have, if possible, a resistance to absolute earth not exceeding one ohm. This bus should be connected at various points by low-resistance conductors (1) to multiple-driven pipes adjacent to the station, (2) to all other available ground sources such as river beds, canal beds, water piping, wells and swampy ground, or (3) in lieu of multiple-driven pipes because of the nature of the soil, to cables buried in the ground and run in radial direction from the ground bus, also (4) to overhead ground wires brought to the steel structure of the station.

### *Equipment Connections*

To the common ground bus there should be connected by an individual conductor (1) each steel column of the building or structure, (2) each transformer tank, oil circuit breaker tank or frame, ground bus of switchgear, and generator, motor and synchronous condenser frame, (3) generator and transformer neutrals, and (4) by numerous conductors, individual ground bus on each floor of the building.

For grounding switchgear each of the metal structures, metal panels and metal supports of insulation panels should be individually connected to the switchgear ground bus. This bus should not be smaller in current-carrying capacity than 25 percent of the highest continuous current rating of any piece of primary apparatus (power circuit breakers, current and potential transformers, disconnect switches, relays and meters) to which it is connected. The switchgear ground bus should, in turn, be connected to the common station ground bus by conductors having a current-carrying capacity equal to that of the switchgear ground bus.

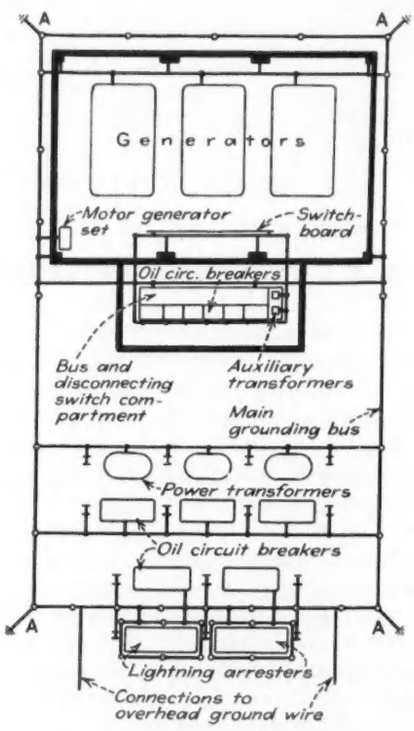
In isolated-phase stations, where a ground-fault relay protective scheme is used, it is necessary that all of the stationary metallic parts of the switchgear not at bus potential be connected to a fault-current bus, a section of the latter being provided for each section of the main bus. In turn, each section of fault-current bus is connected to the station ground bus through a current transformer.

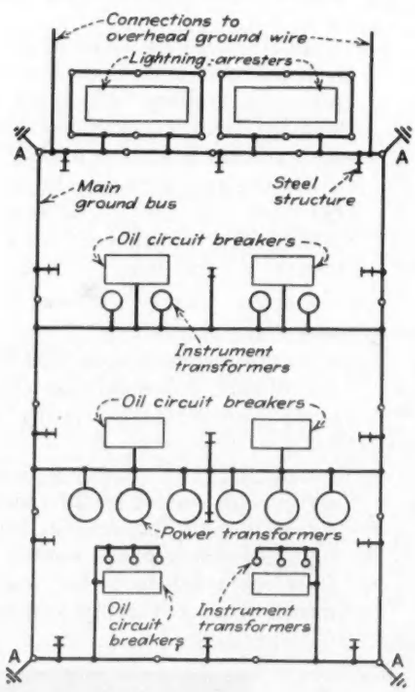
### *Lightning Arresters*

A local earth connection for lightning arresters should be made by driving pipes into the ground directly below the arresters. Resistance between all the pipes connected in multiple and the common ground bus should not exceed five ohms. This local pipe ground should be connected by cable to the common ground bus.

If a substation has structures for two or more different voltages, a ground bus should surround each structure. These several ground buses should be connected together by low-resistance conductors and leads run off at convenient points to the ground sources.

An iron or steel fence inclosing outdoor substations should be grounded by running a ground bus underneath the fence and connecting the two at frequent intervals. This ground bus should be connected in a number of places by cables to the main ground bus.




**Typical grounding system for a generating station (above) and an outdoor substation (at right). Frequent connections are made to moist earth, wells, water pipes and other good ground sources as indicated at points A. Circles indicate driven pipes spaced approximately 15 ft. apart, except at lightning arresters, where 10-ft. spacing should not be exceeded**

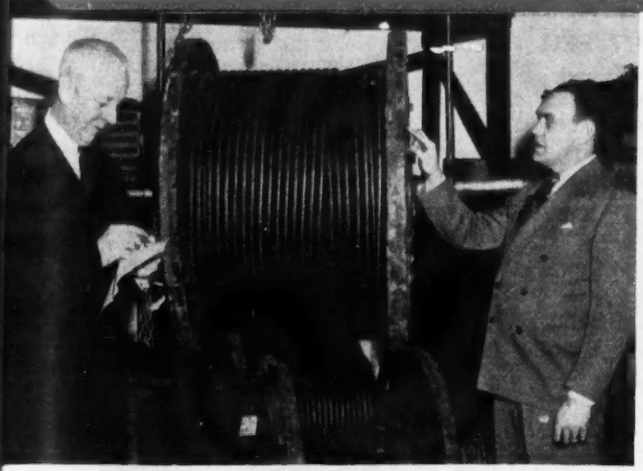
# G-E Wiring Materials Distributors Offer Supplies For Wartime Wiring Maintenance

You can obtain the wiring materials needed to keep wiring systems operating efficiently from the G-E Wiring Materials Distributor near you. Over 175 of these distributors are located at key points in different parts of the country. You'll find this close source of supply particularly helpful in maintaining today's tight 24-hour production schedules.

Your G-E Wiring Materials Distributor handles the full G-E line of high quality materials—conduits, boxes and fittings, wires and cables, BraidX, bus-drop cable and wiring devices including Silvend fuses having silver-plated contacts. This line, of course, includes materials suitable for wiring additions, wiring conversion and new war project wiring too.

Ask a representative of your G-E Wiring Materials Distributor to call. He'll show you maintenance materials particularly suited for your requirements. His experience will also be valuable in helping you to plan wiring changes and needed new wiring.

Leo Michale, outside salesman, General Electric Supply Corporation, Rockford, Ill., is shown here just as he leaves to visit customers. Mr. Michale's territory includes the northern Illinois and southwestern Wisconsin area. He has been with the Rockford GESCO since its inception.

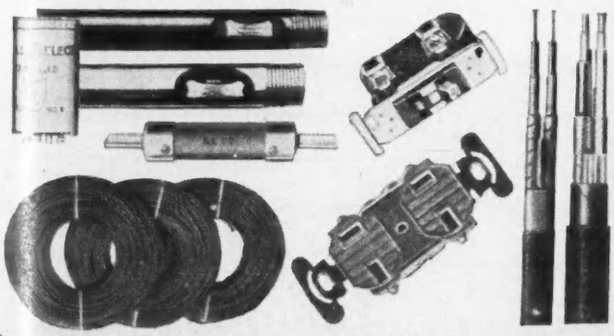


C. H. White (left), and E. L. Hall, salesmen, representing the General Electric Supply Corporation houses at Portland and Bangor, Maine, respectively, are here checking cable for a Maine war industry customer.

H. C. Marquardt (left), sales representative, General Electric Supply Corporation, Rochester, N. Y., is here discussing conduit, wire and wiring devices suitable for large war project with members of the Industrial Electric Co., Rochester, who are handling the project's wiring. Left to right in the photograph: Mr. Marquardt, Theodore Benz, H. W. Davison and Charles Granning.

G-E WIRING MATERIALS

See your G-E Wiring Materials Distributor about conduit, wire and cable and wiring devices. He is eager to serve you. Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

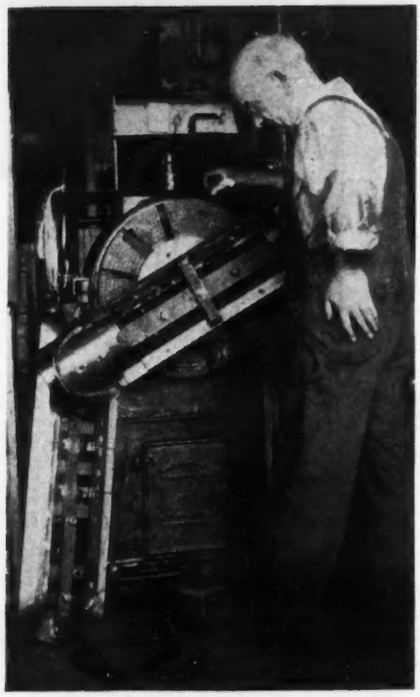


GENERAL ELECTRIC

Fred Reisdorph (left), stock clerk, Central Queens Electric and Lighting Fixture Corporation, Riverhead, Long Island, N. Y., G-E distributor, is delivering an order of lamps to Stanley Hubbard, electrical dealer, who furnishes lamps to Long Island duck growers.

## Heavy-Duty Winding Machine

The Portland (Ore.) General Electric Co. shop has in service a heavy-duty coil-winding machine which is operable with forms for approximately 100 types of coils, including diamond-shaped coils for motors and generators, 3,600-kva. transformers, constant-current transformers, etc. The illustration shows the machine along with the three forms necessary for winding the coils of a type IRS 2-46-kw.-60-cycle, Form F4 regulator, 2,600-volt primary and 200-amp. secondary. John Gates, one of the chief operatives in the coil-winding department described the machine.



**FRONT VIEW of heavy-duty winding machine with foot pedal starter and dynamic brake. The form on the machine and two on the floor are for winding coils for a regulator**

They utilized an old pipe-threading machine, powered by a 2-hp., 600-volt d.c. motor. The cast-iron drip pan on the front of the machine was taken off. On the front was the usual chuck for gripping the pipe. All attachments were removed, leaving only the circular plate of the chuck. To this was attached another circular plate approximately a foot in diameter by $\frac{3}{4}$ in. thick, through which various bolt holes had been drilled and threaded, for attaching various types of forms. To give the form clearance, however, it is not bolted directly to the plate, but a piece of 4x6 timber is inserted flatwise between, making in effect a 4-in. thick "washer" to hold the form out from the machine.

The machine is started and stopped by means of a treadle-operated switch provided with dynamic brake. Speed adjustments are made through equipment originally on the machine; namely, manually operated rheostat further augmented by cone pulleys. The direct-current motor with rheostatic control lends itself admirably to the coil-winding operations. The machine and all materials necessary to the conversion were available, without buying anything new.

•

## Air Breakers Chop Charging Current

On one of the major power systems in Canada a number of 138-kv. air-blast breakers have been installed in the past ten years. Numerous short-circuit tests have been made on these breakers which proved their interrupting ability; however, no tests were made on any of the installations to determine the performance of that type of equipment on interrupting leading kva. or long line charging current.

A recent addition to their power system was an underground cable which had 120 amp. r.m.s. charging current. It was possible to make comparative charging current interrupting tests on the cable. The oscillograph reproduced shows the charging current being interrupted first by an air-blast breaker and secondly by an oil breaker. The results are so conclusive that a discussion of the film is unnecessary.

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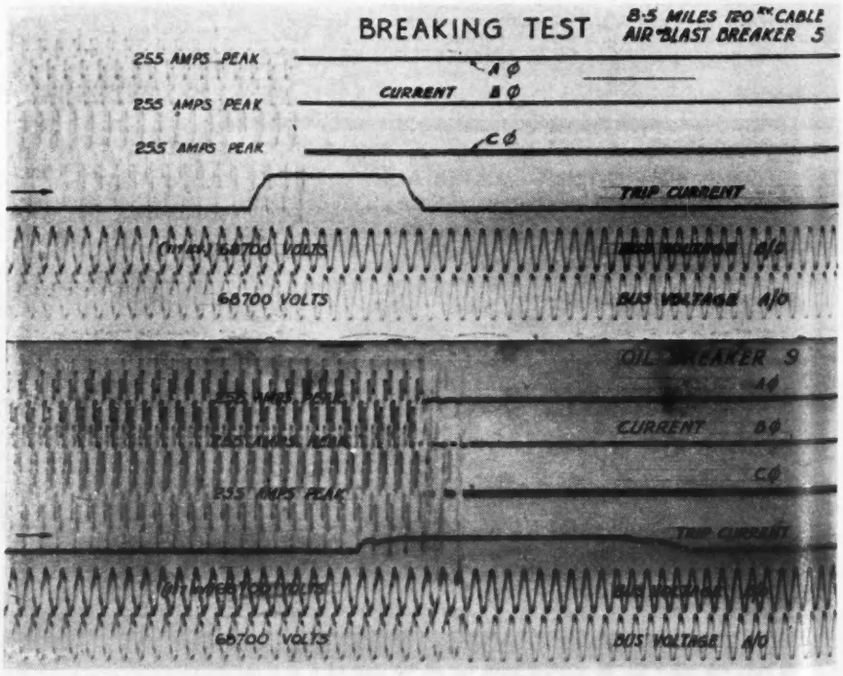
## Five Ways to Save Fluorescent Lamps

By E. W. BEGGS
Westinghouse Electric & Manufacturing Company, Bloomfield, N. J.

While there has been no shortage of fluorescent lamps in the United States it is proper to consider how to conserve these lamps to eliminate unnecessary waste of power and material.

Five major steps to be taken in prolonging lamp life and obtaining maximum illumination are: (1) Use proper accessories; (2) be sure line voltage is within range specified; (3) turn lights on and off as little as possible; (4) check contacts and electrical connections; (5) replace worn lamps and starters promptly. Details for each step are presented.

Use auxiliaries that are certified




**OSCILLOGRAMS give conclusive evidence of ability of air-blast breakers to interrupt cable changing currents**

# Did you forget to tell him what to do now?

● It's a fire-fighting axiom that the first 60 seconds of a fire are the most important. If something goes wrong then, you may have a real blaze on your hands.

Alert management, recognizing this, carefully trains its employees to fight fire. It picks key men in the plant, teaches them how different fires behave, how various extinguishers must be handled.

Authorities agree that *demonstrations* provide the best training. So Walter Kidde & Company has prepared a booklet—"How to Teach Fire-Fighting." It tells how to stage a fast-moving, interesting, instructive fire-class. Write for your plant's copy.

**Walter Kidde & Company, Inc.**
**428 West Street** **Bloomfield, N. J.**

**Kidde**
HIGH PRESSURE GASES · FIRE PROTECTION
PROTECTS LIVES

or are otherwise known to have the proper operating characteristics. They can be depended upon to give the longest fluorescent lamp life.

Good starters will properly preheat the electrodes before the lamp is started. They will start the lamp promptly, but not too quickly. It takes about one full second to bring the electrode to the proper temperature to release the proper quantity of electrons.

Unless the electrode is at its emitting temperature when the arc strikes it will suffer an unnecessarily severe impact of the arc with resultant loss of useful life.

Good ballasts will also provide the proper preheating and operating amperage, start the lamps gently and run them at their designed output in wattage. This results in the best performance and longest life.

Be sure that the voltage at the fixture is well within the range specified on the ballast. The proper voltage range for 118-volt ballasts is 110 to 125 volts, for 208-volt ballasts is 195 to 220 volts and for 236-volt ballasts is 220 to 250 volts.

Today with the intense industrial activity and generally higher loading of the wiring of buildings, many lighting systems are overloaded or are receiving inadequate voltage. Where this is the case provisions should be made as soon as possible to raise the voltage at the fixture perhaps by changing the taps on the distribution transformer involved.

### *Low Voltage*

Low voltage which causes excessive flashing of the lamp when starting is likely to shorten lamp life. This is the result of inadequate preheat current to the electrodes combined with a starting "kick" of reduced voltage. In extreme cases low voltage also results in inadequate heating of the cathode during lamp operation.

Turn the lamps on and off as infrequently as possible. Where it is necessary to do so occasionally be sure that the starters used are of the high performance type which provide full electrode preheat time and that the ballasts are properly designed to give the proper preheat current. High-performance fluorescent lamp starters for 15, 20 and 30-watt lamps are designed to provide from one to five seconds preheat time, for the 40-watt lamp provide from 1½ to seven seconds, and for the 100-watt lamp from three to ten seconds.

Check all contacts and electrical connections. If the base pins of the lamp do not make good contact in the lampholder, the lamp is likely to flash on and off, seriously reducing its service life. In fixtures that have been in service for more than a year it may be necessary to tighten the binding nuts that hold the lamp holders so that good contact is obtained.

Replace worn-out lamps or starters promptly because either one will damage the other in a short time. Ordinary starters with a wornout lamp will blink, which will eventually cause the starter contacts to wear away or stick. Also, worn-out starters fail to give the proper starting impulse. This results in lamps not starting promptly and the resulting flashes tend to shorten the service life of the lamp. In cases where the starter reaches the end of its service life because the contacts stick together the lamp electrodes are subjected to continuous heating, which shortens the useful life of the lamp and may overheat the ballast.

**CHECK voltage at the fixture. A wall panel check tells nothing of the voltage drop in the local wiring**

Fluorescent lighting equipment that is well designed, well constructed and equipped with high quality auxiliaries will give the longest life performance. Such units provide the best lighting with the least trouble.

These special precautions indicate the most important steps to take to conserve lamps. The suggestions regarding checking voltage and mechanical condition of the fixtures are perhaps those which are most timely.

The check points are important from a mechanical and electrical viewpoint, but there is one additional step to be taken to increase lamp efficiency. The reflectors, glass panels and lamps should be washed with soap and water every time the fixtures are inspected, to eliminate wasted light due to dust and dirt.

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# Series Capacitors—Where Place? How Big?

## Unique Advantages — I*

By S. LUBIN
Engineer, REA Technical Standards Division

The series capacitor is a current-operated device which responds only to the current flowing through it. Since it is insensible to system voltage fluctuation originating between it and the power source, it can be used as a voltage regulator which responds automatically and instantaneously to variations in load current. It can, therefore, be used to reduce flicker difficulties due to motor starting.

It has the additional advantage of producing voltage correction proportional to the load current beyond the capacitor without the necessity of mechanically driven controls. When properly applied it can, therefore, in many cases provide a simple and practically maintenance-free method of voltage regulation. Such an installation will compensate equally well for voltage drops due to inductive loads, or voltage rise due to leading power factors. This latter condition is a phenomenon almost unique with rural systems and frequently encountered under light load conditions. However, since introduction of a series capacitor has the effect of changing circuit constants, and may in some cases cause "hunting" of synchronous machines or self-excitation of induction motors, proposed applications should be carefully checked as to the type of load which will draw current through the capacitor and possible effects of the installation.

Series capacitors may also be used in conjunction with induction regulators to provide closer regulation on selected portions of the system.

* First of a series of nine articles.

# Can you find the Three Saboteurs?

YOU'LL have to look sharp to see them. But there actually are three "saboteurs" in this picture. They are Glare, Shadows, and Dirt. Glare from half-shaded bulbs (A and B in diagram below) and reflected glare from shining metal surfaces (C). Shadows on the work (D). And Dirt on walls, ceilings, and light fixtures (E and F).

You'll find them even in the new streamlined plane factories. But the plants they love best are the ones that never worked a night shift before. Plants where lighting was originally installed *only as an aid to daylight.*

Already more than 3000 lighting men are pledged to help speed war production with better lighting. Representatives of electrical wholesalers and contractors, electric service companies, lighting equipment manufacturers. As Wartime Lighting Counselors, they are checking up on war plant lighting and suggesting simple changes that require a minimum use of critical materials.

The results in improved production have been amazing. But so far their efforts have barely scratched the surface. Right in your own territory many plants and shops are struggling to run a night shift in light that was never adequate even for daytime production!

It's a job that's really important to the war effort. And it calls for the cooperation of every lighting man in America!

What are *you* doing to help?

**G-E MAZDA LAMPS**

**GENERAL ELECTRIC**

# Electric Welding

## and TIREX CABLES

TIREX SELENIUM Rubber Armor — Unequalled for Long Life, Toughness and Resistance to Abrasion

Welding, as a process, is very old but with the advent of electric welding new fields of usefulness were opened up. Along with the rapid development and steady improvement of electric welders there have been equally interesting and important changes in the power and electrode cables used with them. Cables for such service must have flexibility, they must resist abrasion and they must be economical in operation.

Among the first TIREX rubber-sheathed cables designed for special work were TIREX Welding Cables having conductors made up of thousands of small copper wires to obtain flexibility (#4/0 has 5341), a tough rubber sheath for resistance to abrasion and with every promise of unusual serviceability. Performance records have repeatedly shown TIREX Welding Cables to be unexcelled in every way for the work they were designed to do.

TIREX rubber-sheathed Welding Cables are subject to War Production Board restrictions governing the use of copper and rubber but even with necessary modifications they still are suitable for the rough-and-tumble work of welding and can be depended upon for excellent performance. While they are not available for purely commercial uses they should be specified and used by industries on essential war work having high priority.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

# Simplex WIRES and CABLES

# HOW ONE COMPANY
# STREAMLINED OLD MANHOLES

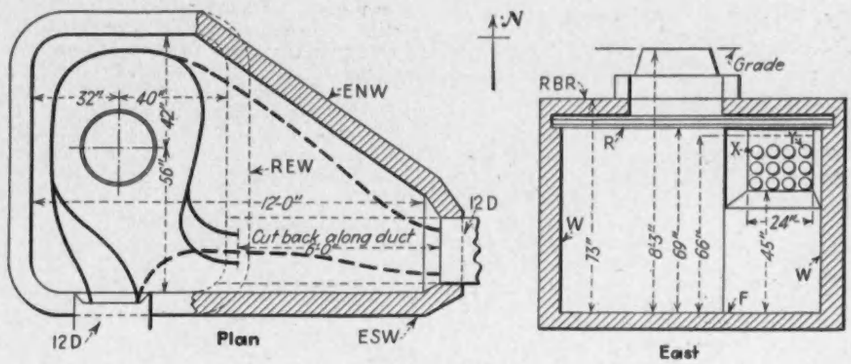
By F. A. HUBBARD, Electrical Engineer New Bedford (Mass.) Gas & Edison Light Company

Manholes built many years ago on the electric distribution system of the New Bedford Gas & Edison Light Company provided inadequate facilities for proper bending and allowance for cable movement judged by today's requirements. In two cables installed before 1916 eight breaks were found in the lead due to cable movement. To replace this cable (in general No. 4/0, three-conductor, 13.2-kv. lead-covered design) would require large quantities of new materials; hence patch wipes were made of the lead sheaths and at the same time the manholes were redesigned to insure better training and racking of the cables. The eight breaks found did not cause failures because the duct lines and manholes were dry. The manhole changes required the minimum of vital materials and helped keep trained underground personnel busy on strictly cable work. Typical redesigns are shown:

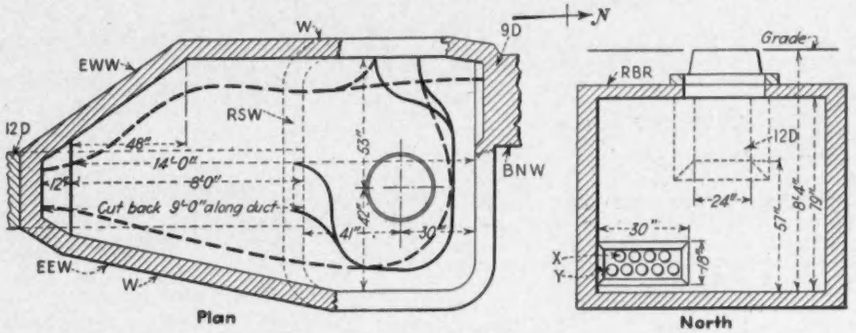
(A) Original design did not provide for cables to go directly east and south without going around manhole. Congestion at bellmouths resulted, with sharp bend at east bellmouth. Rebuilt manhole eliminates this condition.

(B) Initial design was poor and necessitated cables over 1 in. in diameter encircling manhole to provide space for splice. Sharp bends were unavoidable. Rebuilding permitted installation of three-conductor, 750,000-cir. mil, 15-kv. cable north to south with minimum bends.

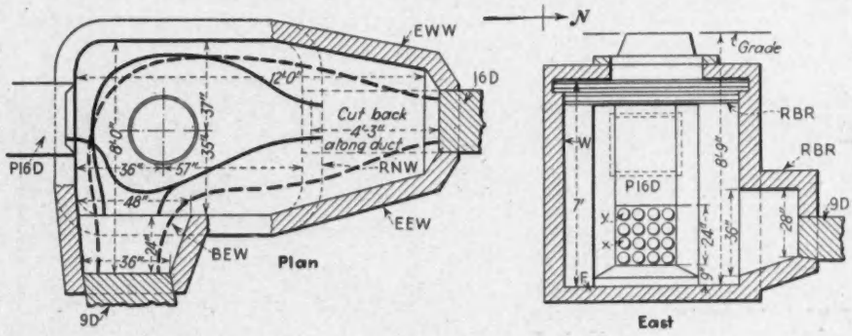
(C) Original design good for north-south cables on west side. Sharp bends in cables on east side; entire manhole limited cable size. New duct line from east necessitated extension on north and throat on east. Enabled to install a three-conductor, 750,000-cir. mil, 15-kv. cable east to north with minimum bend.




Manhole A




Manhole B




Manhole C

## NOTES

Heavy solid line indicates cable before manhole enlargement.

Heavy broken line indicates cable after manhole enlargement.

X, Y designate 750,000-cir.mil cable.

RNW, REW, RSW, RWW = Remove north, east, south, west wall, respectively.

BEW, BNW = Break out section of east, north wall, respectively, and build large bellmouth for new duct run.

ENW, EEW, ESW, EWW = Extend north, east, south, west wall, respectively.

F = new concrete floor.

W = new 8-in. brick wall.

R = Rails.

RBR = New roof—brick and rail.

9D, 12D, 16D = Nine (four over five), twelve, sixteen ducts.

# Maintenance Guide for Electrical Systems*

Following general suggestions for the maintenance of electrical equipment in industrial and other establishments are from a published report of the maintenance committee of the International Association of Electrical Inspectors covering substations, wiring, lighting equipment, control equipment, motors and arc-welding sets:

### *Transformers*

Test temperatures of transformers operating at full load at least once a month. Oil temperature of oil-immersed, self-cooled transformers should never exceed 90 deg. C., and such transformers should not be permitted to operate for long periods of time above 80 deg. C.

Check oil in transformers every three months and replace leakage and evaporation loss. Inspect for oil leaks in transformer tanks. Check ground lug and ground circuit.

Condition of transformer oil should be tested at least once a year. If dielectric strength is less than 18 kv., oil should be reconditioned. New oil should be tested before being placed in transformer and should have a dielectric strength of at least 18 kv.

### *Lightning Arresters*

Inspect all lightning arrester connections in early spring just before lightning season and every other month during summer. Measure ground resistance just before lightning season begins; if it exceeds five ohms, make necessary improvements to lower to five ohms or less. Never run ground wire through iron or steel pipe for protection against mechanical injury unless wire and pipe are bonded together.

### *Wires and Cables*

Wiring systems subjected to vibration should be inspected monthly. All mechanical connections such as locknuts, bushings, etc., should be tightened. Bond wires and ground connections should be checked. Check system to make certain that no hazards have developed since last inspection such as oil or water leaks near raceways, steam pipes installed near cables or raceways, all wiring in switch boxes, motor connections, etc., for possible mechanical injury. Where vibration is not present, this inspection should be made annually.

Examine drop cords and portable cables every three months when in regular use. Repair any damage or severe wear such as found at point where wire enters lamp sockets, plugs and portable appliances. Keep extension cords away from radiators, steam pipes, nails, hooks and other metal objects. Keep rubber cords out of sunshine as much as possible and free from oil, grease and chemicals. Keep lamp guards in place.

### *Switch Boxes, Panel Boxes*

Inspect all metal boxes of wiring system monthly. (In locations that are particularly dusty, boxes should be cleaned out weekly.) Make certain that all covers fit tightly and are in place; keep all unused "knockout" holes plugged tightly. Bond wires and ground connections should be checked.

### *Fuses and Switches*

Inspect all fuses twice each year to ascertain that circuits are not over-fused. Keep fuse clips clean and tight and check all connections to prevent overheating. Inspect closely for any evidence of overheating as a result of high resistance contacts or overloads. Examine refillable fuses, replacing charred cases, making certain that cases are refilled with links of proper rating, and that fuses are assembled tightly.

Inspect switches at same time fuses are checked. Inspect closely for evidence of overheating as a result of high resistance contacts or overloads. Check operation of "quick-break" features.

### *Lighting Equipment*

Type of maintenance schedule needed will vary widely with type of plant and size of installation but it should include the following five-point program:

1. Provide easy access to all luminaires.
2. Clean luminaires regularly with soap and water.
3. Replace lamp outages promptly.
4. Paint walls and ceiling light colors and keep them light.
5. Maintain rated voltage at luminaires.

*This is the first in a series of three articles based on the March, 1943, report of the IAEI Maintenance Committee.

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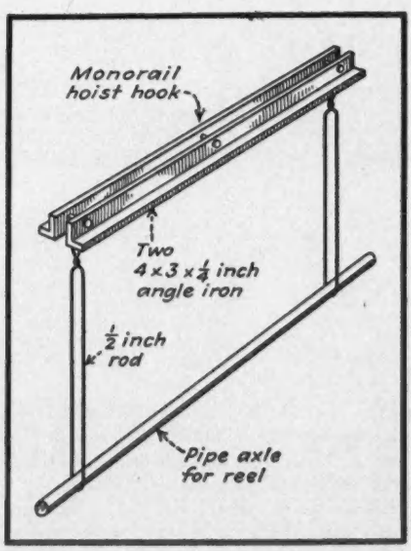
# Cable Reel Sling Made of Angles

By W. E. SMITH
Superintendent of Electric Distribution,
Rockville Center, N. Y.

For moving loaded cable reels around on the storehouse monorail system a sling was made out of two 4 x 3 x ¼-in. angle irons long enough to span the widest reel used. They are spaced far enough apart to take the hoist hook between them. The actual slings are two twisted loops of ½-in. rod. These, in turn, are made sufficiently long to provide for the largest diameter of cable reel handled. Bolts at the ends are ¾-in. and at the middle, for the hook, 1 in. in diameter. As designed the rig is good for a 3-ton load with plenty of margin for safety.




SLING for cable reels used in storeroom on monorail system

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# Portable 37½-Kva. Transformer Unit

By CHARLES J. BAKER
General Superintendent
Light and Water Department, Tarentum, Pa.

A single-phase, 37½-kva. transformer has been very useful as a portable rig to facilitate replacements and changeovers. The unit is placed on a platform built on a chassis purchased from a mail-order house. A shaft was attached for towing and a removable picket fence erected around the edges. Primary and secondary leads from the unit run to crossarms resting on the top fence rails; the primary crossarm carries two cutouts.

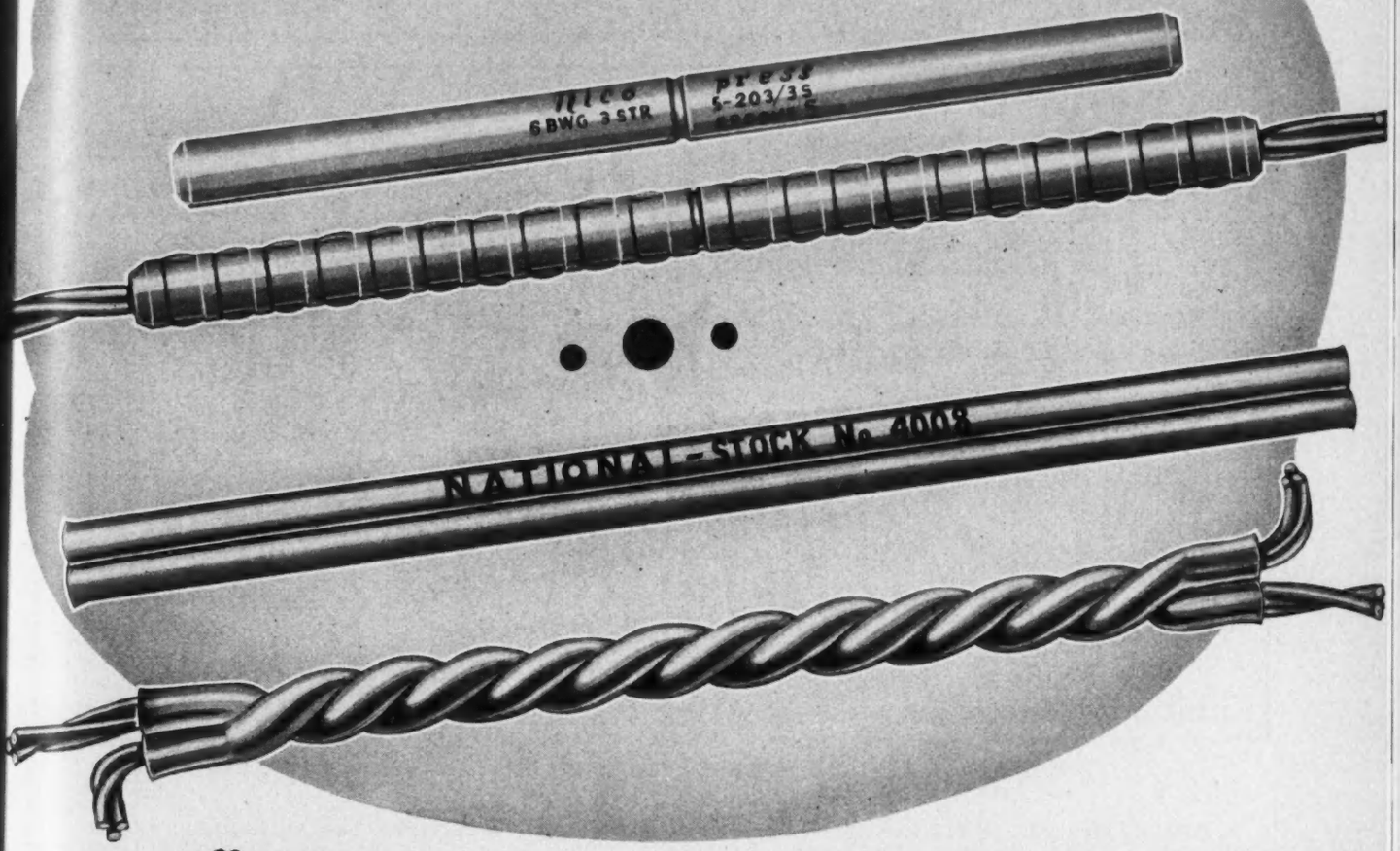
The connected leads are 60-ft. lengths of 5-kv. rubber-covered wire, No. 4 for the primary and No. 4/0 for each of the three secondary leads. These are coiled up in the end areas when not in use. A red light is connected to the secondary and mounted at each corner of the fence as a traffic warning. A padlocked chain passed through all four wheels prevents movement when the unit is placed at the curb and connected around the transformer to be removed or replaced.

### *A 25-Kva. Unit*

Another transformer of 25 kva., 2,300/110 volts was mounted on a two-wheel trailer for use in thawing frozen water pipes. It was first reconnected for 55 volts and in this way gives up to 400 amps. The 250-ft. length of secondary leads are reeled off to the disconnected meter and a hydrant and from 10 to 30 minutes after closure of the single-pole secondary switch the pipe is usually thawed out.

L-M connectors were used for making the primary connections of both equipments.

# 2 Ways to Splice 3-WIRE ALL STEEL POWER CONDUCTORS




## 1. BY THE *Nicopress* COMPRESSION METHOD

***Nicopress* SLEEVES**

| BWG WIRE SIZE 3 STRAND | SLEEVE STOCK NO. | TOOL REQUIRED |
|---|---|---|
| 8 | 5-165/3L | 3-L |
| 6 | 5-203/3S | 3-S |
| 4 | 5-238/3W | 3-W |

## 2. WITH TINNED COPPER GROOVED OVAL TWIST SLEEVES

***NATIONAL* TWIST SLEEVES**

| BWG WIRE SIZE 3 STRAND | SLEEVE STOCK NUMBER | SLEEVE LENGTH INCHES |
|---|---|---|
| 8 | 4008 | 8 3/4 |
| 6 | 4006 | 11 3/4 |
| 4 | 4004 | 13 |

**ALL OF THESE SLEEVES ARE FOR SPLICING 3 WIRE STEEL STRAND. FOR PRICES AND DETAILED INFORMATION CONTACT YOUR JOBBER OR WRITE DIRECT**


**THE NATIONAL TELEPHONE SUPPLY COMPANY**

*Manufacturer of Specialties for Power and Communication Lines*

5100 SUPERIOR AVENUE • • CLEVELAND, OHIO

*Canadian Mfr.*—N. SLATER CO., LTD., HAMILTON, ONT., CANADA

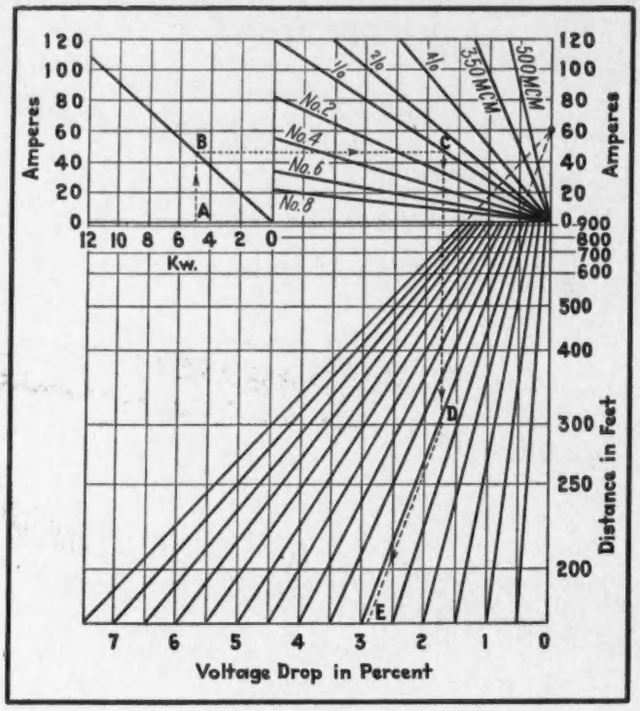
*Export Distributor*—INTERNATIONAL STANDARD ELECTRIC CORP., NEW YORK, N. Y.

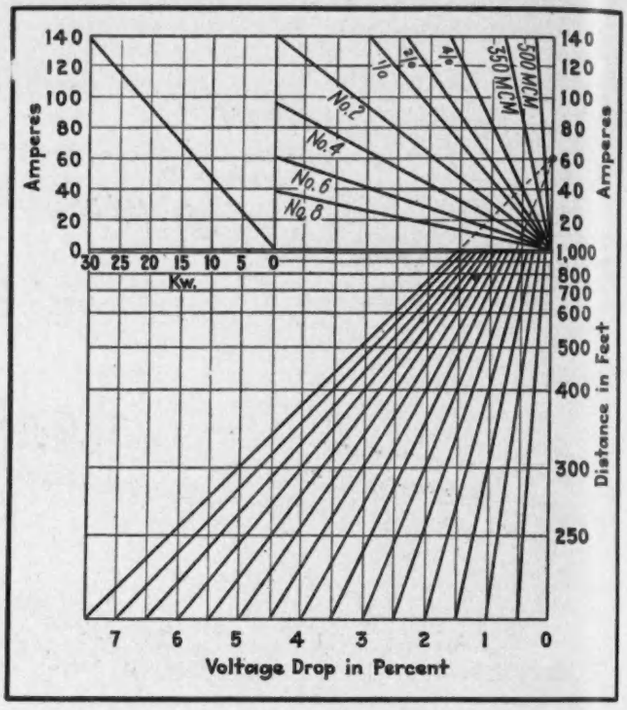
# Voltage Drop Charts for Copper and ACSR Conductors (Correction)

Accompanying charts supersede similar charts used with two articles "How to Determine Secondary Drop" for single-phase and three-phase circuits, by F. C. Rand, in ELECTRICAL WORLD, August 22, 1942, page 93, and November 14, 1942, page 106, respectively. The following charts for single voltages are presented to correct errors on the scales "Voltage Drop in Percent" and "Kw. at 460 Volts" when the author's charts were edited for publication.

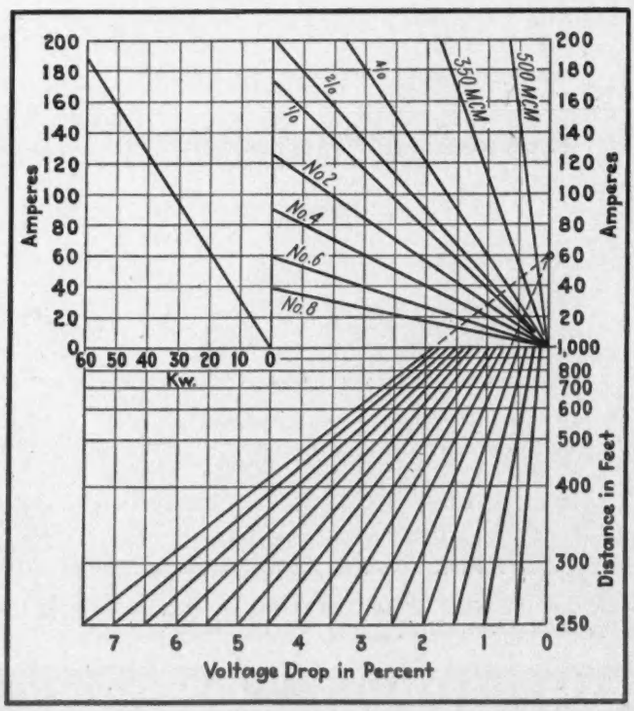
Instructions for use of the charts are not changed.

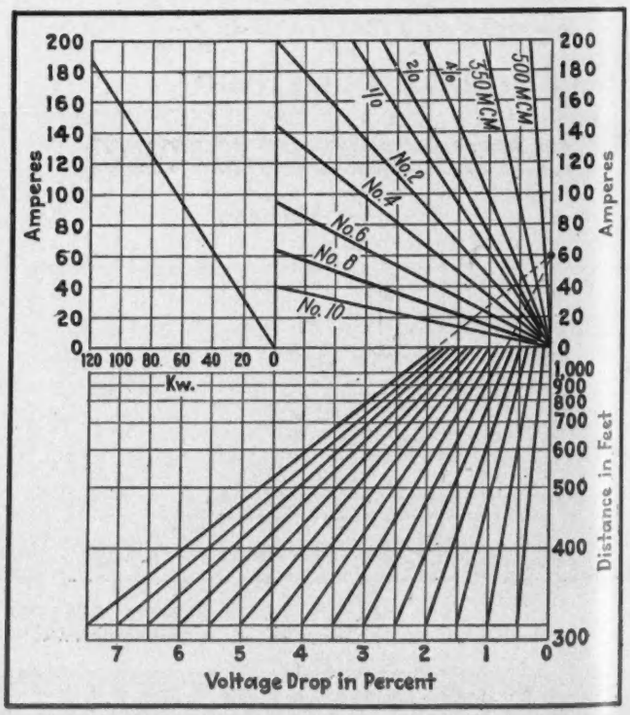
**FOR SINGLE-PHASE, 115- (left) and 230-volt circuits. Assume 95 percent power factor load, 6-in. conductor spacing**




**FOR THREE-PHASE, 230- (left) and 460-volt circuits. Assume 80 percent power factor load, 6-in. conductor spacing**



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# COLONIAL COLD CATHODE *Fluorescent* LIGHTING*

INSTANTANEOUS LIGHT ★ LONG LIFE ★ LOW OPERATING COST ★ MINIMUM MAINTENANCE

FULL RANGE OF COLORS ★ STANDARD LENGTHS ★ CUSTOM DESIGNS

UNDERWRITERS' APPROVED FIXTURES

"The record speaks for itself," says Mr. R. J. Wensley, General Manager, I. T. E. Circuit Breaker Company, Philadelphia, Pa., "we used 40 feet of Colonial Cold Cathode Fluorescent Lighting in 1941; 400 feet in 1942; 40,000 feet in 1943."

*Send for "Cold Cathode Fluorescent at War," the story of the I. T. E. Circuit Breaker Company installation, reprinted from "Illuminating Engineering."

COLONIAL *Lighting*

DIVISION OF COLONIAL NEON COMPANY, INC.

NORTH BERGEN, N. J.

Address all inquiries to the attention of

JOHN C. SABATINI

# HOW TO MAKE

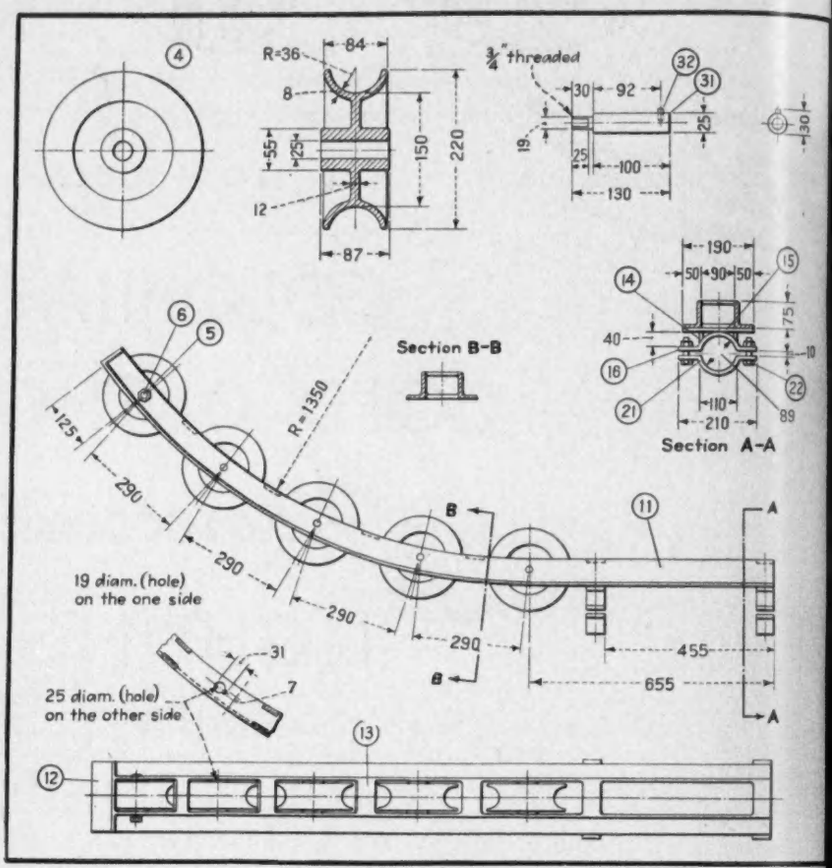
# A GUIDE FOR PULLING CABLE

"Sector-sheaves" have been developed to relieve strain on cables when being drawn around corners of trenches. Presumably they can be used for another purpose which is timely; that is, to guide cables out of a manhole without injury when it is necessary to draw out cables for use elsewhere.

Accompanying design data and illustrations of typical applications are reproduced here by courtesy of Wm. A. Del Mar, chief engineer of Habirshaw Cable and Wire Divisions of Phelps Dodge Copper Products Corp. at Yonkers, N. Y. The material was presented to Mr. Del Mar by Henry S. Angelo, who, when last heard from, was chief electrical engineer of the Nordsjaellands Elektricites og Sporvejs Aktieselskab, Hellerup, Denmark.

FIG. 1—Strain on cable reduced by use of sector-sheave at sharp corner

FIG. 2—Sector-sheave guides cable in or out of conduit when the pull approaches the vertical

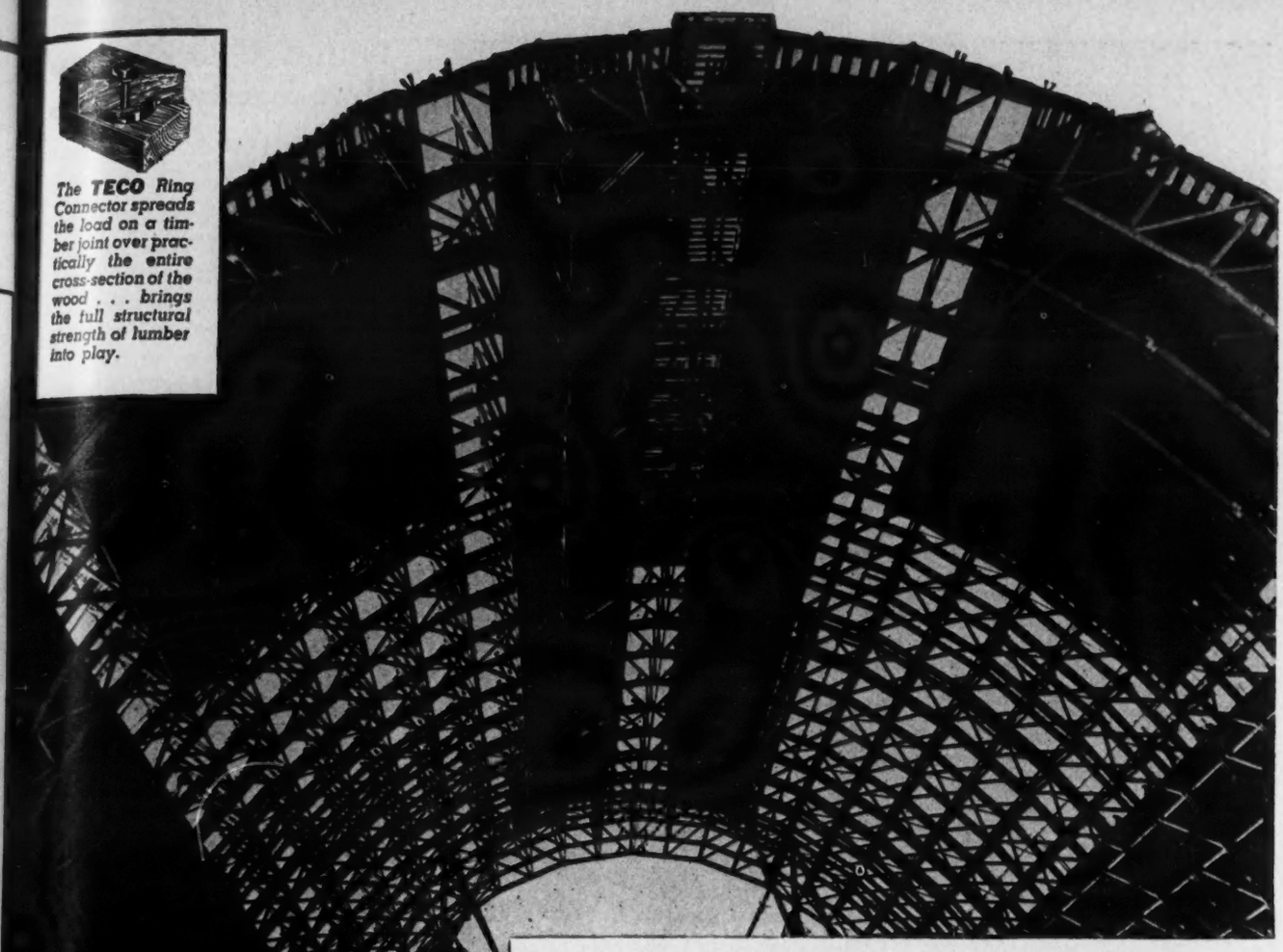


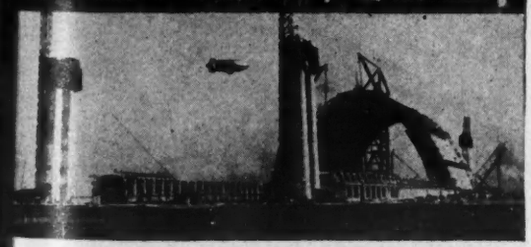

PARTS LIST

| No. | Item | Quan. | Dim. | Length | Material | Finish | Remarks |
|---|---|---|---|---|---|---|---|
| 4 | Sheave | 5 | 210 | ..... | Cast iron | Hot galvanized | ..... |
| 5 | Nut | 5 | ¾ in. | ..... | ..... | ..... | ..... |
| 6 | Spring washer | 5 | ¾ in. | ..... | ..... | ..... | ..... |
| 11 | Angle | 2 | 75x50x7 | 1980 | DIN 1612 | Hot galvanized | Welded together |
| 12 | Flat | 1 | 75x10 | 190 | DIN 1612 | Hot galvanized | Welded together |
| 13 | Flat | 10 | 50x10 | 90 | DIN 1612 | Hot galvanized | Welded together |
| 14 | Flat | 4 | 50x8 | 30 | DIN 1612 | Hot galvanized | Welded together |
| 15 | Flat | 2 | 50x12 | 190 | DIN 1612 | Hot galvanized | Welded together |
| 16 | Flat | 2 | 50x12 | 235 | DIN 1612 | Hot galvanized | Welded together |
| 21 | Flat | 2 | 50x12 | 235 | DIN 1612 | Hot galvanized | Welded together |
| 22 | Bolt | 4 | ⅝ in. | 60 | DIN 1613 | Hot galvanized | Welded together |
| 31 | Round steel | 5 | 25 diam. | 130 | DIN 669 | Hot galvanized | ..... |
| 32 | Pin | 5 | 7 diam. | 15 | DIN 669 | Hot galvanized | ..... |

* All dimensions in table and drawing are millimeters unless otherwise indicated.
Conversion factor: 1 mm. = 0.03937 in.
NOTE: DIN = German Engineers' Standards.

*The* ***TECO*** *Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.*





*New Navy Blimp Hangar, 1000 feet long; 153 feet high; clear-span roof 237 feet. Timber treated for fire resistance according to Federal specifications. Trusses prefabricated by Timber Structures, Inc., Portland, Oregon.*

# OUR NAVY BUILDS WORLD'S GREATEST TIMBER STRUCTURE

*mammoth blimp hangar was made possible by*

## TECO CONNECTOR ENGINEERING

Two announcements of the widest import to American engineering have just come out of Washington.

The U. S. Navy has announced that a giant blimp hangar, engineered entirely in timber, is nearing completion "somewhere in the continental United States."

The War Production Board has announced that "such a structure could not have been built of wood by ordinary methods without the use of timber connectors . . . The steel ring timber connector, which is used to increase the strength of joints in wood construction, saved more than 400,000 tons of steel for essential war production in 1942." WPB added that 2,050 tons of structural steel will be saved in this hangar alone.

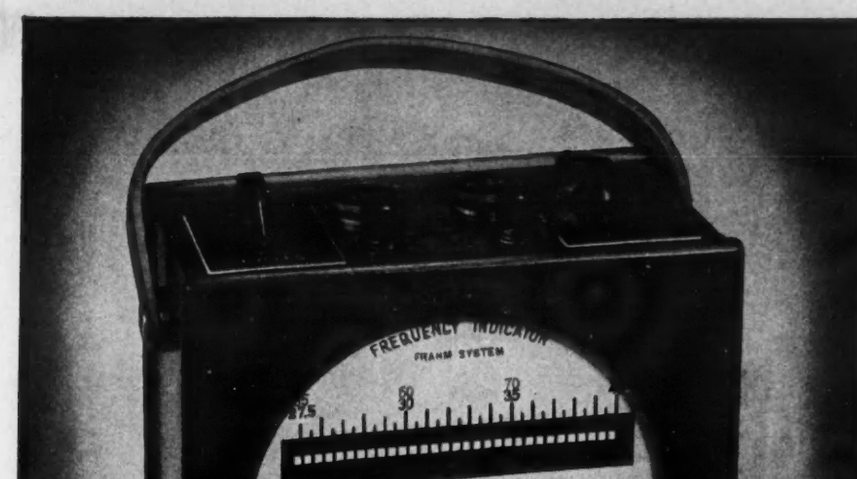
In erecting this vast, multiple-truss assembly, Navy engineers have accomplished a notable achievement in modern timber connector engineering. The hangar is the latest of scores of large Navy, Army, and Maritime Commission projects built with Teco timber connectors under the revolutionary Teco system of timber engineering. It is one of *over 100,000* heavy-duty structures, of *over 600* types, built under the Teco connector system in the past few years. They include clear-span factories, bridges and trestles, towers, tanks, warehouses, docks, shipyards, and many others.

Write today for our FREE Reference Book for engineers and architects showing 45 *"Typical Designs of Timber Structures."*

**TIMBER ENGINEERING COMPANY**

NATIONAL MANUFACTURERS OF TECO TIMBER CONNECTORS AND TOOLS

WASHINGTON, D. C. PORTLAND, OREGON




THE "FRAHM" PORTABLE
VIBRATING-REED
FREQUENCY METER

As dependable as it is rugged, this wide-range Portable Frequency Meter is a vital adjunct to any laboratory or testing department. The set of synchronously vibrating (or *tuned*) and electro-magnetically actuated reeds do not easily get out of order or lose calibration; and they are unaffected by wave form or by ordinary temperature changes. Various ranges to as low as 10 and to as high as 500 cycles per second are available in both portable and switchboard types.

The Miniature type Frahm Frequency Meter has recently become popular, largely because it has the same ruggedness and dependability of the larger instruments.

**Write for descriptive Bulletin 1695-W.**

**James G. Biddle Co.**

1211-13 ARCH STREET *Electrical and Scientific Instruments* PHILADELPHIA, PA.

## Sound Slide Films Help Safety Training

By LYNE S. METCALFE
New York, N. Y.

Acceleration of the pace in pow production as a result of warti needs and the influx of much new a partially trained or untrained help the industry have required the ste ping up of safety precaution pr grams among electric utilities. R cently first aid programs have be augmented with a visual system co sisting of a series of 20 sound sli film (film strip) productions, two which have been produced in Tech color, and each synchronized with

**COMPLETE KIT of sound slide films a instructors' guides**

lecture on disk record and correlate printed textbook.

These films were produced in c operation with the Bureau of Med cine and Surgery and the Bureau Aeronautics of the United State Navy and are in regular use by th Navy. Recently they have been ma available to all industry.

This visual program is not intende to supplant tested and tried metho of first aid instruction—such as le tures, demonstrations and physica practice on live models. Rather the are intended as an aid to the first ai instructor, saving time in transmittin the basic principles of approved fir aid procedures, and allowing the i structor to devote more time to a tual demonstration and practice wi classes.

Among the power companies whic

have had wide experience with this visualized system is the Jersey Central Power & Light Company, Asbury Park, N. J., of which J. T. O'Brien is safety director.

This company has used the films as a "refresher." At the present time the company has more than 700 employees holding either standard or advanced Red Cross certificates and about 25 instructors.

"We hold monthly safety meetings," said Mr. O'Brien, "for all our employees. At this time we show one of the visualized lessons on some phase of first aid work, then throw the meeting open for discussion. If any of the practices recommended by the slide films do not agree with company policy, we discuss it at this time. We have found the sound slide film kit very helpful in promoting discussion and clearing up any faulty techniques in first aid training."

There is a total of 1,084 individual pictures in the series, photographs, drawings, charts and exhibits.

Many users consider the first aid slide films effective in motivating safety practices. They can be used to give vivid safety lessons long remembered. The large lighted pictures enable the safety director to *show* the "working parts" of the body and its "care and repair."

•

## Transformer Shop Practice Summarized

Distribution transformer shop maintenance practices of eight member companies of the Wisconsin Utilities Association, as surveyed by the service operations committee, are summarized as follows in the committee report:

*Question:* When a transformer is brought into the service shop for inspection or repairs what method of procedure is followed to determine its condition.

| Company | A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|
| Are oil tests made? | (1) | No | Yes | No | No | (3) | Yes | Yes |
| Is oil drained and filtered? ..... | (1) | No | Yes | — | (2) | (4) | (5) | Yes |
| Are bushings cleaned? ..... | (1) | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

**Explanatory Notes**

(1) All transformers are tagged by line crew removing unit. Tag indicates reason for removal. If in good operating condition when removed it is set aside and given general inspection and test. Inspection includes test of oil, which is drained and filtered if necessary. If necessary, bush-


NEW LOW-PRICED
Permaflector 200 WATT FLOODLIGHT!

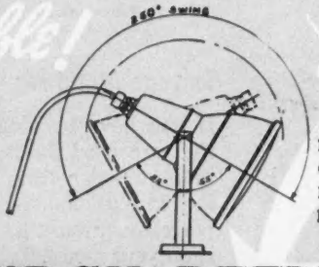
PERMAFLECTOR ENCLOSED FLOODLIGHT ST-200 FOR 200-WATT INCANDESCENT

Powerful beam of light from a standard 200-watt lamp! Offers higher priced mechanical and performance features at low cost. Built to "take it", ST-200 is ideal for service on power shovels, bulldozers, trucks and cranes; completely adjustable

SHOCK and WEATHER-PROOFED

Silver-mirrored glass PERMAFLECTOR; housed in corrosion-resistant sheet steel; convex, stippled, heat-resisting, 8⅜" lens; porcelain socket; weatherproof cord grip fitting. 12½" high overall; weighs only 6½ lbs.

Adjustable! Date!




250° swing vertically; 360° horizontally, by adjusting wing nuts on bracket and base.

200-watt PS-30 Incandescent Lamp
Beam spread ..... 50°
Overall spread ..... 145°
Lumen output ..... 2565
Beam candlepower ..... 7400

PITTSBURGH REFLECTOR CO.

MANUFACTURERS OF LIGHTING EQUIPMENT AND THE FAMOUS Permaflectors
OLIVER BLDG. PITTSBURGH, PENNA.

Please rush complete data on small-wattage PERMAFLECTOR Floodlight ST-200 — *EW 4-43*

NAME.....

ADDRESS.....

CITY..... STATE.....

# A NEW line of PINCO Equipment Bushings

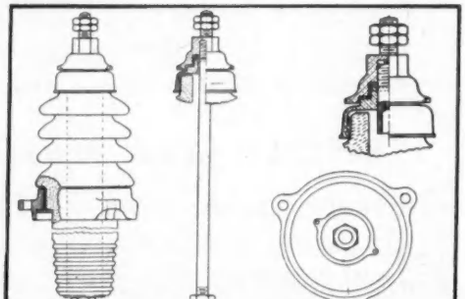
PINCO BUSHING
No. 2557

Built to Pinco "right on the job" standards, these new dry type equipment bushings are designed for use on voltages from 7.5 KV up to and including 25 KV. For use with currents up to 400 amps, flanges are of galvanized electric furnace annealed malleable iron. Above 400 amps they are furnished with bronze flanges.

# PINCO means Insulator service

The new Pinco Bushings are made up of Pinco Standard high voltage, high quality porcelain with special attention being paid to relation between porcelain and metal at cemented areas, and to alignment of flanges and terminals. All joints are properly gasketed and each bushing is given a lengthy, carefully checked test under substantial pressure to make sure it will be satisfactory for operation under either oil or gas conditions. Bushings of these types are carried in stock in quantities for immediate delivery.

*Send for your copy of the New Pinco Insulator Catalog—or consult the Pinco listing in the Electrical Buyers Reference.*



Bushings are furnished in either draw lead or fixed type terminal as specified by the customer.

## Salvage Metal for "On the Line" Service

If you have bushing terminals and flanges that are good for further use, you can get prompt action from us on the porcelain to use with them. We will either furnish the porcelain or make the porcelain and assemble it on your metal.

PINCO INSULATORS

**The PORCELAIN INSULATOR CORPORATION**
**642 Main St. E. Lima, N. Y.**

SALES AGENTS—The Joslyn Company—New York, Rochester, Philadelphia, Baltimore, Lynchburg, Va.; Jobbers Supply Co.—St. Paul, Portland, Seattle; Joslyn Co. of California—Los Angeles, San Francisco, Phoenix, Ariz.; Southern Joslyn Co.—New Orleans; H. E. Burns Co.—Pittsburgh; J. J. Costello—Boston; Southeast Joslyn Company—Cincinnati, Cleveland, Westerville, O., Lexington, Ky., Atlanta, Jacksonville; Paul Douden—Denver; Paul Carson—Amarillo, Texas; Joslyn Manufacturing & Supply Co.—Chicago, Springfield, Ill., Kokomo, Ind., Kansas City, Omaha, Oklahoma City; Joslyn Southwest Co.—Dallas, Houston.


ings are cleansed, gaskets changed and coils cleaned. Dry process porcelain bushings are changed when unit is being serviced.

(2) If necessary, depending on condition.

(3) New oil is used for small size transformers.

(4) Only on large sizes.

(5) Drained and if not too dirty is filtered.

*Question:* What high-voltage tests are made before and after servicing?

Company A—Voltage tests are made including a 10,000-volt test from primary to case and secondary neutral. Double rated secondary voltage plus 1,000 volts is applied from secondary to case. A core loss test is made on all units returned to the storeroom.

Company B—High potential test made if coils are rewound.

Company C—Ratio and polarity.

Company E—High voltage and ratio.

Company F—Primary and secondary voltage checks are made.

Company G—Ratio and polarity are checked with full voltage on primary.

Company H—Each transformer is checked for correct ratio and voltage. In case of a 2.4-kv. transformer 4.5 kv. is impressed to test for insulation breakdown, 15.8 kv. impressed on 13.2-kv. transformer, and in case of a 33-kv., or higher voltage, transformer insulation is tested at twice line voltage rating plus 1,000 volts.

*Question:* Explain types of instruments used.

Company A—Readings are obtained by means of ammeters, voltmeters and a wattmeter.

Company C—Voltmeter.

Company E—Megger, portable indicating voltmeter.

Company F—Voltmeter.

Company G—Megger, voltmeter.

Company H—Standard transformers with voltage regulator and indicating voltmeters.

*Question:* Is the insulation resistance checked with a Megger?

Company A—Insulation resistance measurements are obtained on all transformers over 150 kva. in capacity or operating at a primary voltage above 5,000. This measurement is obtained with a Megger.

Company B—Yes. Also with power factor meter.

Company C—Yes, when transformer has been overloaded or has had moisture.

Company D—Sometimes.

Companies E, G—Yes.

Company F—No.

Company H—No, voltage only.

## Irrigation Quenches Coal Pile Fire


By LEWIS JONES
Overbrook, Philadelphia


Several years ago I quenched successfully a coal fire by applying a small continuous flow of water in trenches cut in the top of the pile. This winter we had equal success in another instance.

The method is to flatten off the

p of the pile with one end higher an the opposite end. The grade or ope is not important, just that it is fficient for water to flow from the gh end to the low end by gravity. hen cover the entire top of the pile y small parallel channels 6 to 8 ft. part and just a few inches deep and eginning at the high end and exnding to the low end. These chanels or ditches are not connected to ach other and one channel should be lose to each side of the pile to care or the slopes.

Then extend a water pipe across he high end of the pile with a ½-in. r ¾-in. valve to feed water into each hannel and turn sufficient water into ach channel to be all absorbed by the ime it reaches the low end and allow his water to run for several weeks.

In our case the ¾-in. valve was not pened much for each channel. A ery large pile would require more ater. We have no idea of the mount used, but think it was negliible as compared to plant requirements.

In October, 1942, a fire was discovered in a storage pile containing bout 2,000 tons of very high-grade ituminous coal which had been oil prayed while being loaded in the ailroad cars. This oil, we believe, ade the coal more likely to fire and he pile was about 16 ft. deep at the igh end and perhaps 25 or 30 ft. ide at the top. Flames had broken hrough at several points on the lopes at the sides and end of the ile. The actual flame was extinguished with small streams of water, hen the pile was irrigated as described.

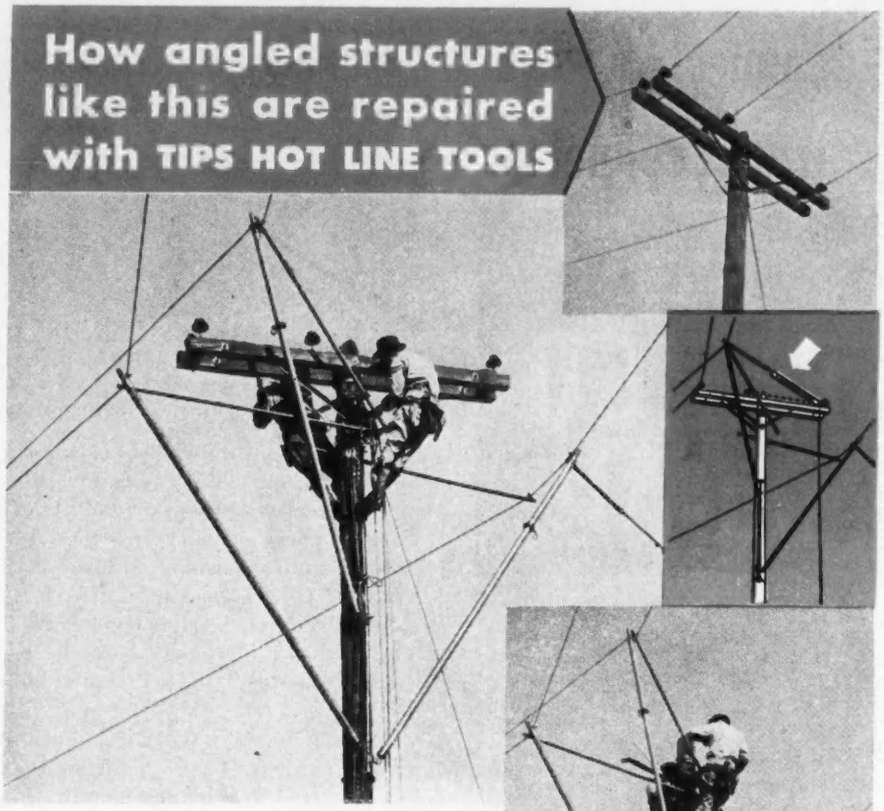
We have now (in March) started o use this coal and have come to spots in the pile that are completely educed to ashes showing that the ire would have been very serious if ot controlled. My present estimate s that we have not lost much over 5 tons of coal. There is still some eat in the coal as we go into the ile, but I believe no fire. We have one into the high end 15 or 20 ft.

•

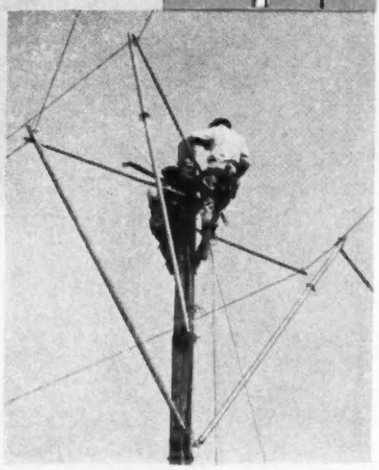
## Duplex Meter Set for Load Surveys

Shown in the illustration is the duplex watt-hour demand meter test set used by the Board of Water and Electric Light Commission of Lan-


How angled structures like this are repaired with TIPS HOT LINE TOOLS

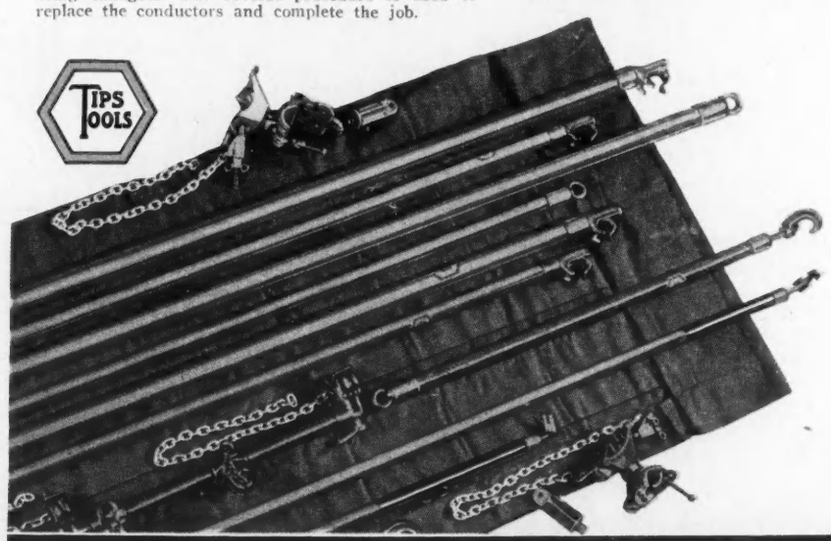


There are very few line repair jobs that cannot be handled with Tips hot line tools. Here a demonstrator shows how to change double arms with conductors pulling at an angle: First attach an insulated link stick and tail line to the outside conductor. Then attach Tips wire tongs which are secured to a slide and saddle mounted on the pole. Untie the conductor with tie sticks and let the ground crew pull the line from the insulator groove with the link stick and line. Guide conductor around the ends of the arm with wire tongs. Lower to obtain slack and push out to a safe distance. To remove the second and third conductors from insulator grooves, attach a set of blocks to the outside of the arm and to the conductor, using link sticks for insulation. Attach wire tongs and untie the conductor. Tighten blocks to relieve conductor, then lift it to a safe distance with wire tongs. The blocks and link stick (see sketch) are then removed and used on the next conductor in the same manner. Blocks are again detached while arm is being changed. The reverse procedure is used to replace the conductors and complete the job.



Shown here are the tools used to handle the double cross arm change on a 20° angle. These same tools can be used on many other hot line maintenance jobs. There are many possible combinations. Consult your Tips Tool catalog for the details on these and other Tips Tools and how to use them.

TIPS TOOLS

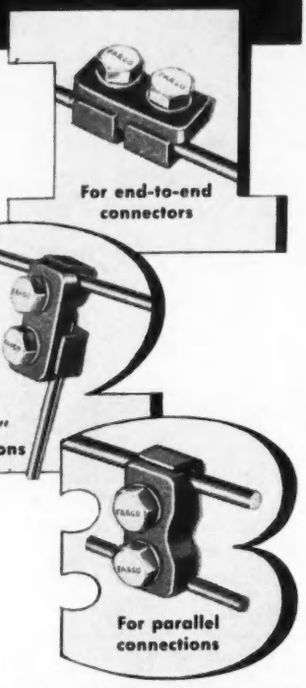


A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC INDUSTRIES

connect 3 ways with 1 connector

the FARGO "Du-All"




Any one of the three ways you use this Fargo "Du-All", you get a sure-gripping, high conductivity contact. To change it from one type of connector to another, simply loosen the clamping member and turn it to the desired position. High strength copper alloy bodies and Duronze bolts that last and last . . . available in a wide range of sizes especially adaptable for industrial and substation use.

Made by FARGO MFG. CO

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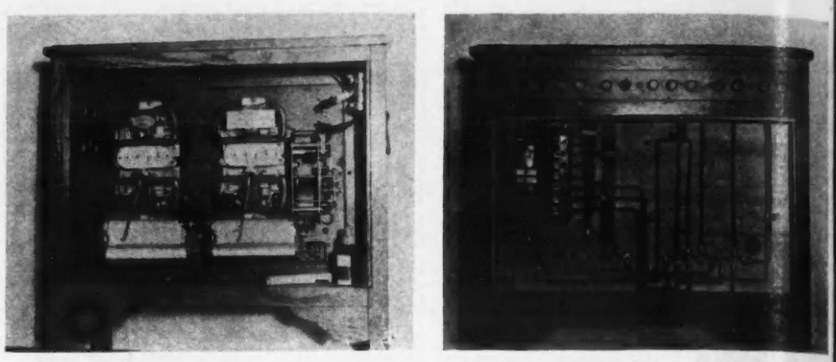
LINE MATERIAL CO.
MILWAUKEE • WISCONSIN

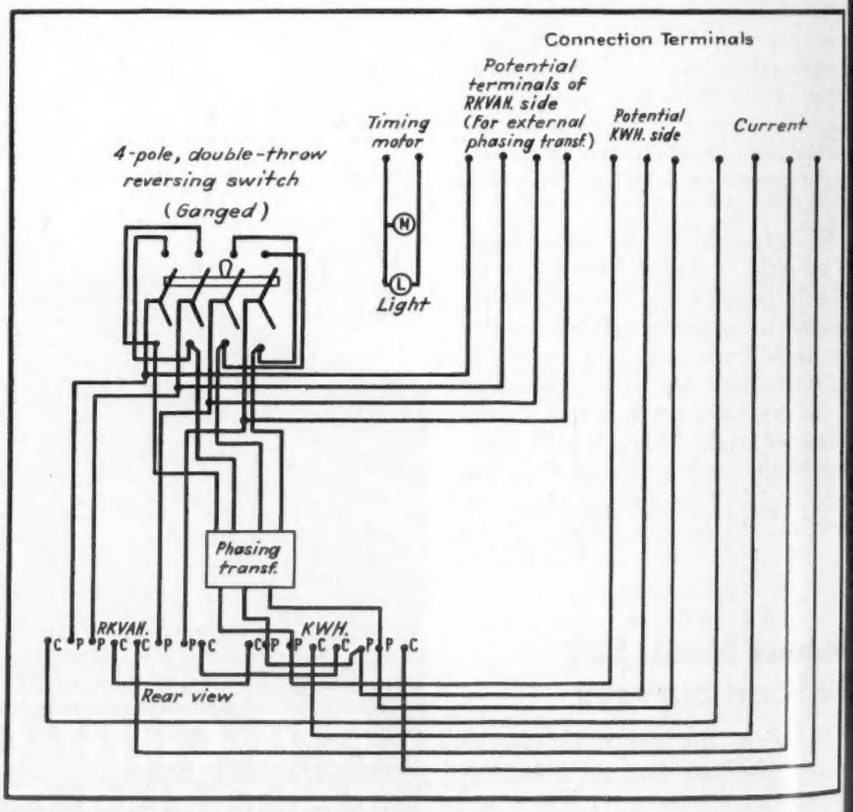
**DUPLEX watt-hour demand meter kit used by Michigan municipal utility for customer load analysis—(left) front view, (right) rear view back panel removed**

sing, Mich., for making tests and surveys of load conditions in industrial plants to check primary or secondary circuits, individual motors and other electrical apparatus. The information obtained is used in showing the customer where, how and what is required to improve power factor and efficiency.

This instrument integrates kilowatt-hours on the left-hand register dial and reactive kilovolt-ampere-hours on the right-hand dial. The left-hand chart makes a record of the integrated kw. (active) demand occurring during a 15-minute interval, and simultaneously the right-hand chart makes a record of the integrated reactive kva. demand. At the end of the 15-minute interval both pens return to zero simultaneously, the interval timing being determined by a small synchronous motor. Chart advance and reset of pens is actuated by a strong clock spring.

From the charts the following information can be obtained:

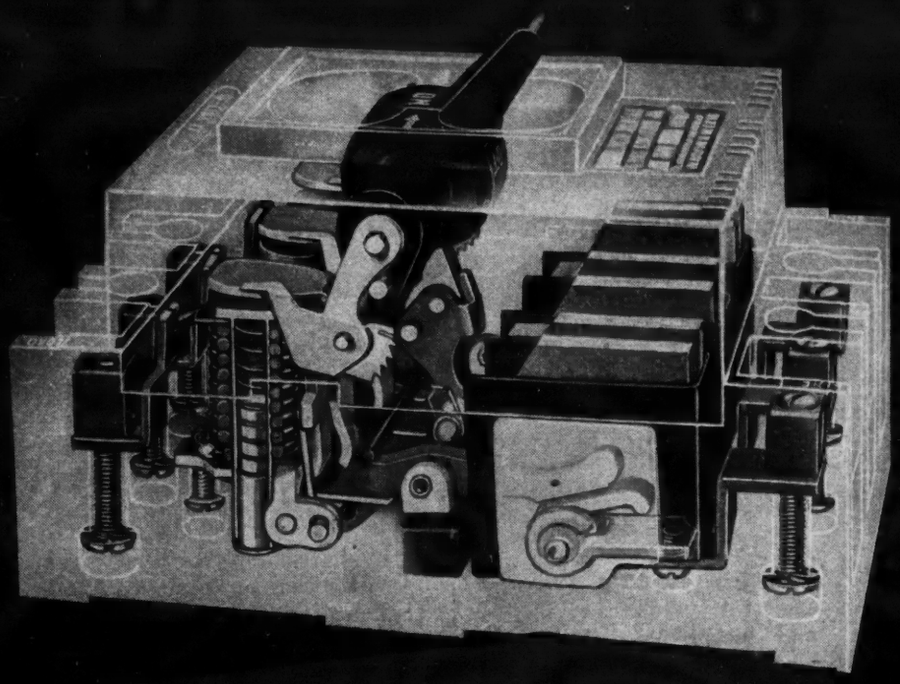
1. Kw. demand (maximum or for any interval).
2. Kw.-hr. used during period of test.
3. Rkva. demand (maximum or for any interval).
4. Rkva.-hr. used during period of test.
5. Kva. demand (maximum or for any interval).
6. Average power factor for period of test.
7. Power factor for any 15-minute interval.
8. Reactive factor.
9. Angle of lag.
10. Horsepower.




**CONNECTION DIAGRAM for duplex meter set**

# Circuit Protection?

Put it up to



HEINEMANN MAGNETIC CIRCUIT BREAKERS

These breakers provide the ideal combination of time delay (to prevent nuisance trips on harmless starting surges) and high speed interruption of short circuits. The time delay may be matched to circuit characteristics by use of different hydraulic media. Ampere ratings between 50 milliamperes and 50 amperes may be matched accurately to the load by proper wire size and ampere turns on the magnet coil. 5,000 amperes short circuit interrupting capacity is accomplished by magnetic blowout action.

HEINEMANN CIRCUIT BREAKER CO.

TRENTON, N. J.

103 PLUM STREET

# LOAD SERVICING

Industrial • Commercial • Rural • Residential

## Customers Co-operate To Cut Service Calls

Calls upon the Hartford Electric Light Company for fuse and appliance servicing show a gratifying drop in 1942, due in large measure to the success of this utility in clarifying the war emergency's effect on motor vehicle facilities normally available in quantity day and night. Advertising to cut down fuse trouble calls began June 24 in the local press, and in the company's various offices typical meter and fusing installations were assembled to demonstrate the ease with which replacements can be made by the public.

Automobile mileage for service calls dropped 45 percent from July to November, inclusive, as indicated by the accompanying graphs. The actual saving was greater, because a certain amount of mileage is, in the words of Vice-President R. D. Cutler, an irreducible constant.

•

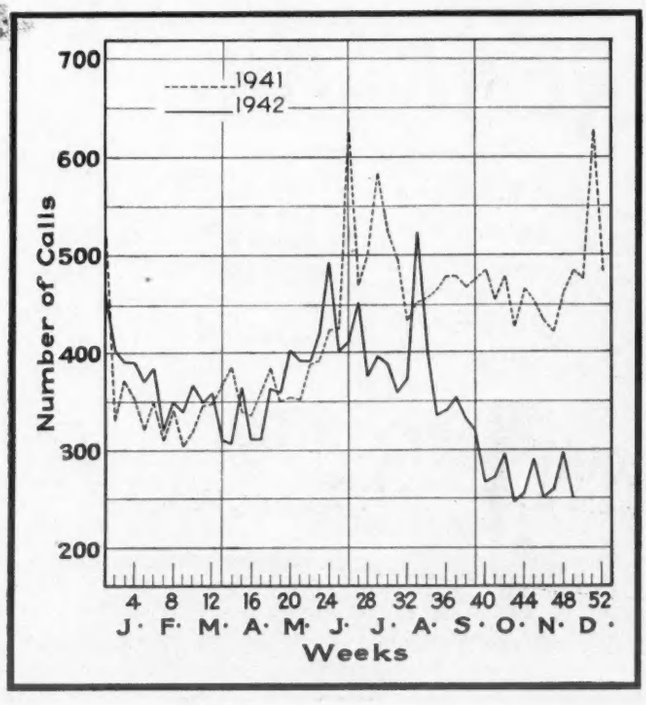
## P. G. & E. Offers Appliance Check-up

A wartime check service has been instituted by Pacific Gas & Electric Company as a means of keeping domestic appliances on the job for the duration. In addition to instructions on care and repair of household equipment, the program incorporates a clearing house for purchase and sale of appliances.

To give a record of the call as well as condition of electric appliances, the residential field representative carries a specially printed card bearing the eight items of service with space for checking each as completed.

Instruction in appliance care is simplified by a booklet, "The Lady of the House and Her Electric Servants," which is used during the demonstration and left with the householder. Where equipment needs repair, the power company representative puts the customer in touch with one of the dealers participating in the P. G. & E. "Durationize" program. He does not stop there, however. He lists on the back of the service card appliances needing repair, action agreed upon with the customer, steps taken and follow-up required.

As a means of teaching the customer to help himself and thus eliminate many service calls, the check



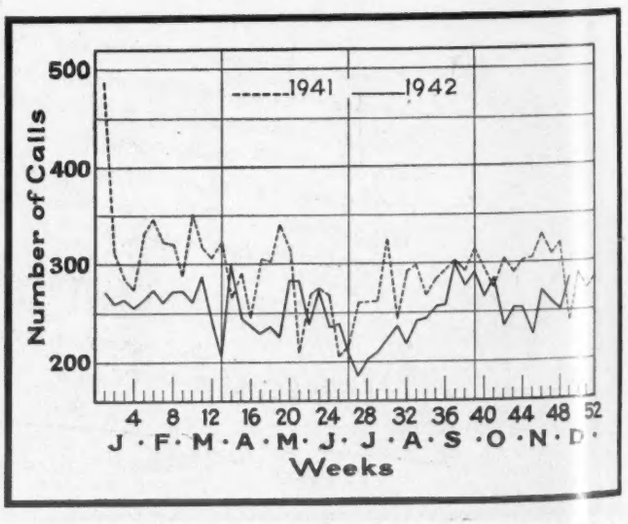
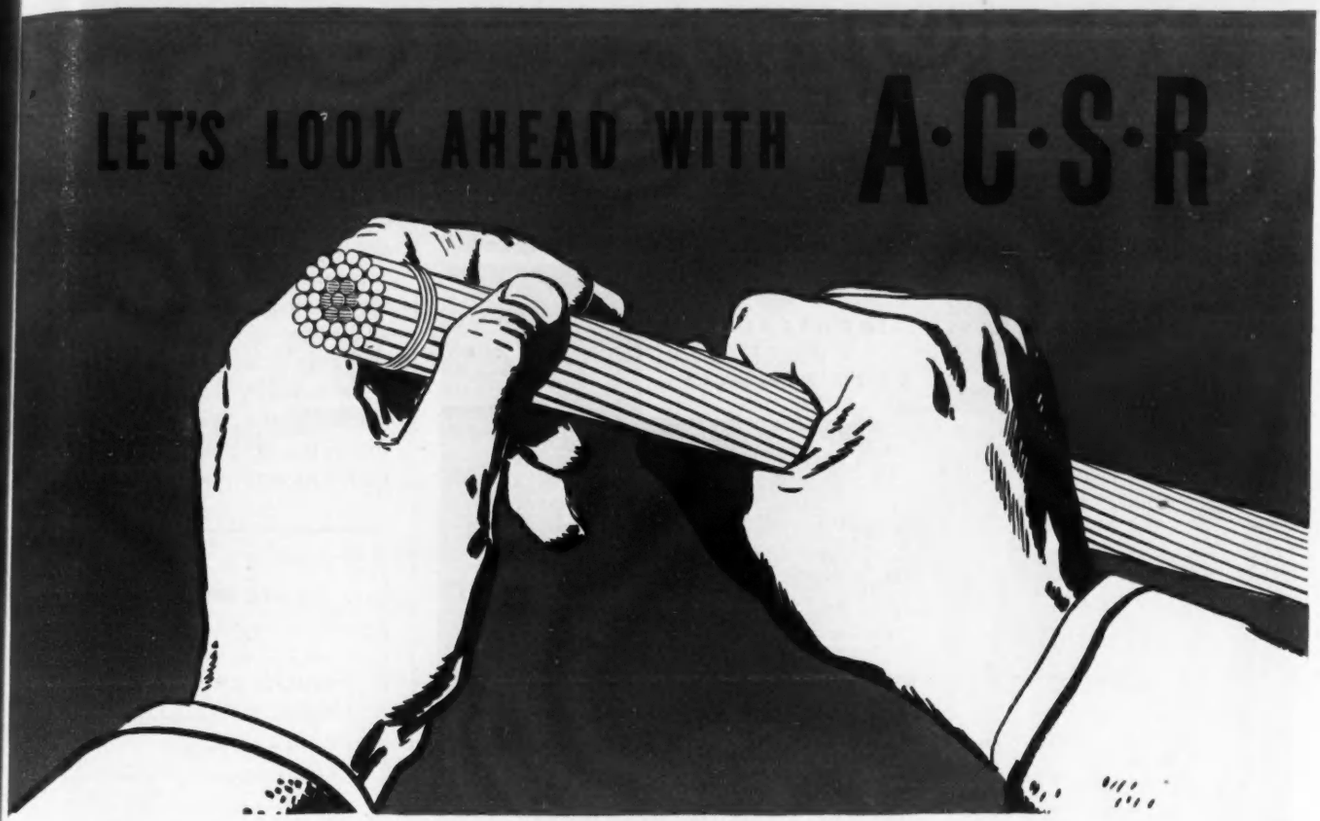




**CHART (left) gives week-by-week number of fuse service calls for 1941 and 1942 (the extreme peaks shown are due to lightning storms), and chart (below) shows trouble calls received weekly by the company for domestic ranges and water heaters and commercial cooking equipment during the two years**

# LET'S LOOK AHEAD WITH A·C·S·R



Voltages far above anything transmitted up to now are predicted for power lines of the near future. A fuller realization of the potentialities of electricity will make such superpower lines necessary. And with the development of those lines, an equally interesting future for A.C.S.R. is certain.

Look at the enviable record already established for Aluminum Cable Steel Reinforced: A thirty-year history of successful performance —a million miles bought for the construction of rural lines and hi-lines—some of this conductor has been in service over a quarter of a century. A.C.S.R. lines are carrying a large percentage of the power used by war industries today.

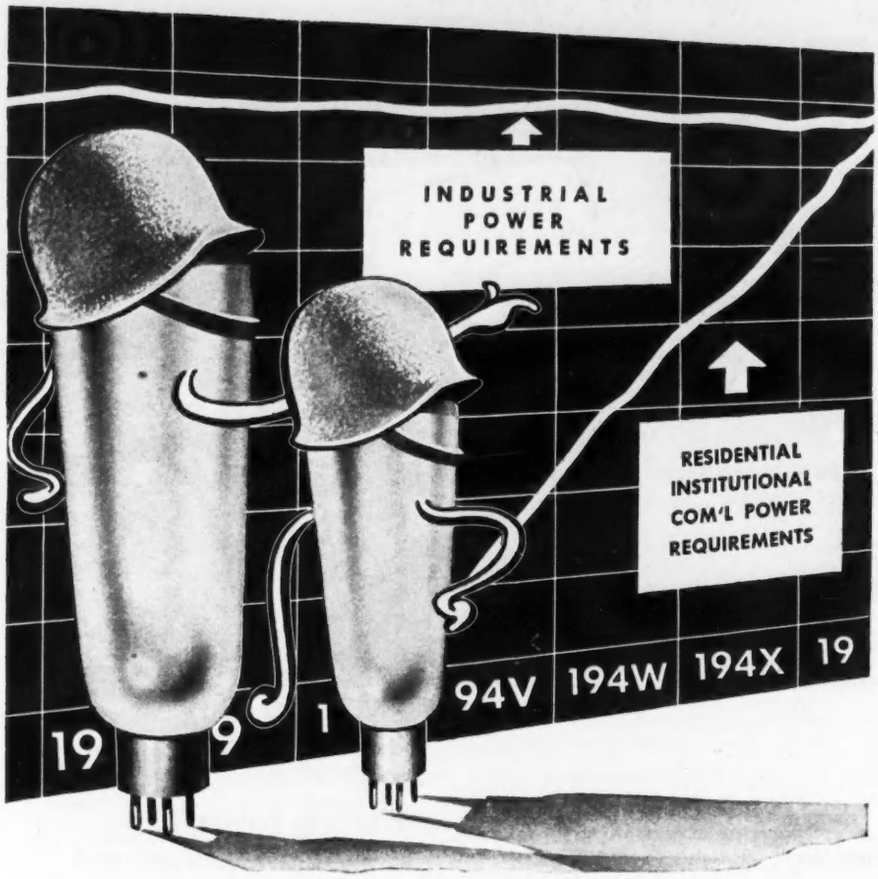
A.C.S.R. owes much of its success to this combination of properties: light weight with high strength and sturdiness, high electrical conductivity, ability to withstand corrosive attack. Too, Alcoa engineering has grown up with the industry, developing stringing standards, accessories, and a perfected system of vibration control, all as demanded by progress.

Those postwar, superpower lines will bring new design and construction problems. A.C.S.R. and Alcoa engineering intend to keep abreast of the trend. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh, Pa.

IMAGINEERING AT WORK

ALCOA A·C·S·R

# "WE'LL PUT ANOTHER MOUNTAIN RIGHT THERE..."




## Electronics-at-war is landscaping the Future

WITH the Electronics Industry in this war today up to its neck, that "mountain" of new power requirements it's going to create is still just a curve on a graph of the future. But in the very process of helping to win this war, Electronics is learning the new tricks that will change that hypothetical "mountain" into actual new power *demands*. For with Victory, plenty of those tricks will be put to work in America's homes, schools, offices, factories — ultra high frequency heating and cooking — fully automatic air-conditioning and daylighting — two-way radio and television.

Are you planning now to meet the changes Victory and Electronics will bring to the power distribution scene? If you are, you'll be glad to learn that Roebling's Development Engineers are looking in that direction, too. Doing more than just looking, in fact. We're making lots of better wires and cables right now to meet Victory's tough specifications. Those very products — Paper-insulated Power Cable, Armored Parkway Cable, Roevar Magnet Wire — are going to help you meet your "landscaping" problems after Victory. For powering war production today, for landscaping the future tomorrow, you can rely on Roebling for your electrical wire and cable needs.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY
Branches and Warehouses in Principal Cities

ROEBLING
ELECTRICAL WIRES AND CABLES

service includes instruction in repairing electric cords and replacing fuses. To make the lesson in cord repair comprehensive, the utility representative uses a short piece of asbestos-covered cord, one end equipped with a plug cap, the other stripped and wrapped in the proper manner for inserting and fastening in a conventional type plug cap. If the customer needs spare fuses, they are sold at the time of the service check.

Where the householder needs equipment, P. G. & E. will sell it if in stock, if not will try to locate it through a dealer and will tell the customer how to make the purchase un-

62-4148 12-42-500 POS

**P. G. and E. WARTIME CHECK SERVICE**

1. Gave information on care and use of appliances . . ☐
2. Arranged for appliance repairs needed . . . . . ☐
3. Helped purchase appliances needed . . . . . ☐
4. Showed how to repair cords . . . . . ☐
5. Showed fuse box and how to replace blown fuses . ☐
   Sold spare fuses needed . . . . . ☐
6. Gave Air Raid Alarm and Dimout information . . ☐
7. Gave list of lighting needs requested . . . . . ☐
   Sold lamp bulbs needed . . . . . ☐
8. Listed condition of appliances . . . . . ☐

Customer_____

Address_____

Town_____

By_____ Date_____

**SERVICE CARD to be filled in by field representative. On reverse side is listed appliances needed for repair and other data**

der WPB rules. In connection with this service, the company lists appliances which householders are willing to sell and customers who need appliances which they cannot procure in stores. From these two lists, both by types of appliances, the field representative can put the customer who has and the one who wants in contact.

### *Future Market*

Looking toward the future, a listing is made on the company's market record and prospect survey form of the condition of appliances in use and whether they are likely to need replacement soon after the war is over and appliances available again.

Also included in the wartime service plan is information on blackout and dimout, including what to do

# "COLD" or "hot" and loaded!

**OPEN CIRCUITS SAFELY . . . UNDER LOAD WITH NEW WESTINGHOUSE LOAD-BREAK DISCONNECTS**

It makes no difference whether the circuit is under load or not—you can open it SAFELY with the new Westinghouse Load-Break Disconnect Switch!

This makes possible greater system flexibility with less switching equipment. It provides inexpensive isolating of primary feeders and sectionalizing of transformer banks . . . UNDER LOAD . . . SAFELY.

The LCB can be opened under load because arcing is confined to a small auxiliary blade and the arc is quenched almost instantly in a "De-ionizing" chamber.

For complete information, call your Westinghouse Office or write for B-3203, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-60520

**RATINGS**

| System Voltage | Switch Rating Continuous | | Interrupting Rating Amperes |
|---|---|---|---|
| | Amperes | Volts | |
| 2,400<br>4,160 | 400 | 5,000 | 400 |
| 6,900 | 200 | 7,500 | 200 |
| 13,800 | 100 | 15,000 | 100 |

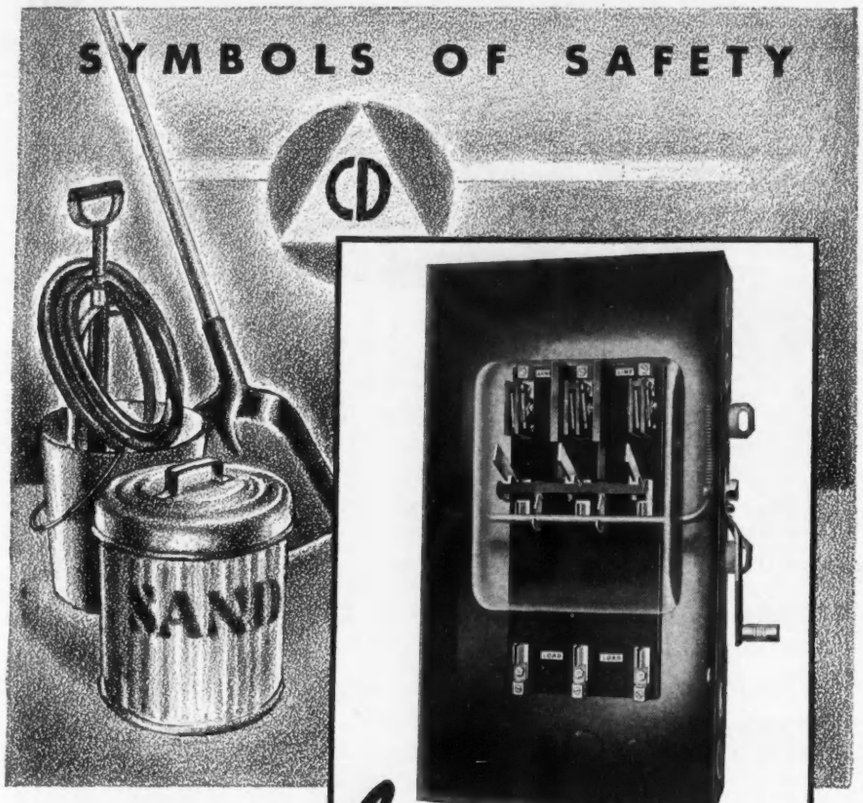
**HOW IT WORKS:** Main blade opens first, leaving auxiliary blade engaged. At a predetermined position, auxiliary blade is snapped open by spring action. Arc is extinguished in "De-ion" chamber.

- For safe, nonautomatic switching.
- For sectionalizing primary feeders.
- For isolating transformer banks, capacitors, voltage regulators, and similar applications.
- For circuit interruption and protection when combined with BA "De-ion" power fuses.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

**DISCONNECT SWITCHES**




Federal Rolarc SAFETY FACTORS

# PREVENT MANPOWER SHORTAGES

Industrial accidents are one reason for manpower shortages. And uncontrolled arcing is one cause of industrial accidents. That's why special safety features are incorporated in Federal Rolarc Safety Switches to control and reduce dangerous arcing to an *absolute minimum* . . . and to increase production by eliminating delays and accidents caused by switch failure.

The parallel cylindrical rollers which "dam up" and snuff the arc give these 575 Volt Rolarc Safety Switches many added advantages. This new method of arc control lengthens switch life — conserves war vital copper — saves valuable time and priceless manpower. Follow the leaders — for extra service and safety switch to Federal!

***For Complete Rolarc Data***

Write for Bulletin 42-12. Contains all the essential facts on the 575 Volt Federal Rolarc Safety Switch.

**FEDERAL ELECTRIC PRODUCTS COMPANY**

54 PARIS STREET, NEWARK, N. J.

PANELBOARDS • SWITCHBOARDS • SAFETY SWITCHES • CIRCUIT BREAKERS


with electric and gas service during air raid alarms.

Each customer who wishes it is given a list of lighting needs as a guide to future buying. A copy of this list is retained by the company and as needed equipment becomes available the customer is notified. While on the premises, the power company representative sells any lamp bulbs needed and any lighting equipment desired by the customer and still in company stocks.

•

## Letter Spurs Load Changes Reports

**NORTHWESTERN ELECTRIC COMPANY**

PUBLIC SERVICE BUILDING

PORTLAND, OREGON

TO OUR CUSTOMERS:

Today it is very important that every precaution be taken to avoid waste of critical materials and interference with war production. During the past few months we have had several transformers burn out, due to customers increasing their electric loads without giving us notice. The shutdown of your operations due to a burnout will materially inconvenience you and may further unnecessarily delay important war production.

In cases involving such burnout we have been obliged to charge the cost of equipment damaged to these customers, as provided in our tariff.

Due to reduced personnel we no longer are able to maintain as close personal contact with our customers as we would like. Therefore, we hope we may have your cooperation in keeping us informed of any contemplated load changes—either increases or decreases—so that we may increase capacity if we find facilities are overloaded or remove idle equipment if facilities are found to be underloaded.

For your information we quote excerpts from our published tariff, "General Terms and Conditions", Sheet 51, Section 4, bearing upon the matter of customer's load change:

"Before any addition is made in customer's electrical equipment, the customer shall notify the Company in writing, thereby giving the Company opportunity to ascertain if any changes are needed in its equipment or distribution system.....If any damage results to the meters, transformers, or other equipment of the Company through failure of the customer to notify the Company in writing of any changes in or additions to customer's equipment, the amount of such damage shall be paid by the customer."

Electrical equipment burned out needlessly is a waste of important critical material. Won't you help us to save time and preserve material so badly needed in the war effort by keeping us informed of any actual or contemplated changes in your load?

Yours very truly,

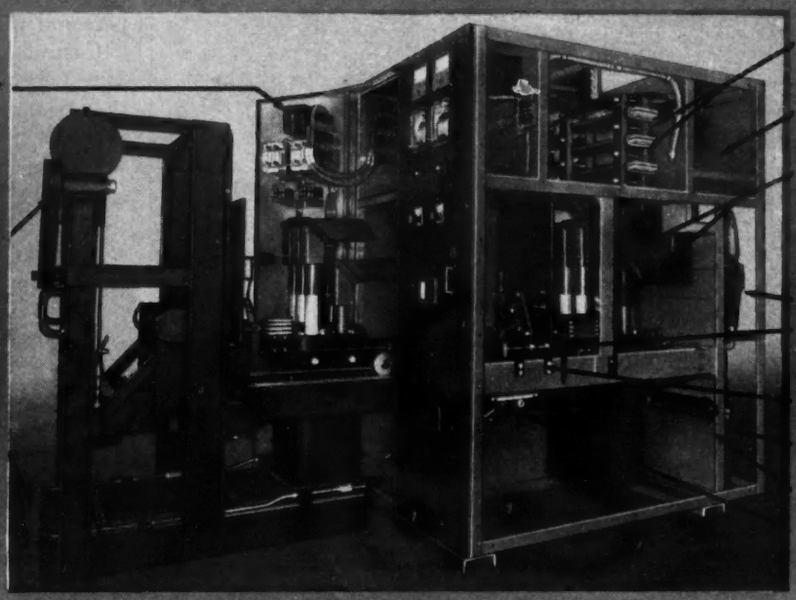
J. C. Plankinton

J. C. Plankinton
Assistant General Manager
Commercial Department

An encouraging response has been received by the Northwestern Electric Company, Portland, Ore., to the accompanying letter sent to industrial and commercial customers. It calls attention to the fact that reduced personnel makes it impossible for the company to make close personal contact as in the past. At the same time it advises the customer of his own responsibility in regard to damage that may result from his failure to report contemplated load increases due to added equipment.

While the industrial sales engineers ordinarily keep pretty close watch on their customers and know which ones are likely to increase their load or,

# Check This Construction




Metal-Clad Structure with End Plate Removed, to Show Circuit Breaker in Operating Position. Breaker in Adjacent Compartment is Being Removed by Means of the Handling Truck.

# Roller-Smith Metal Clad Switchgear

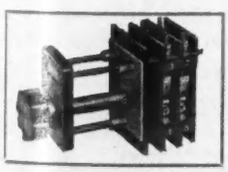
The flexibility needed to meet changing loads in war plants is inherent in factory-built, wired, and tested R-S metal-clad switchgear. It is necessary only to change the incoming leads and mount in new locations.

Metal-clad switchgear saves man-hours, too. Whenever inspection, adjustment or replacement of parts are necessary, it takes only a few minutes to withdraw and replace the circuit breaker with an entire spare unit. Each removable section includes an oil circuit breaker of 100,000, 150,000 or 250,000 KVA interrupting capacity, with primary isolating enclosures; primary, secondary and ground disconnecting devices; mechanical interlocks and racking mechanism.

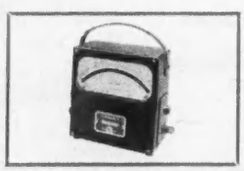
Safety is afforded the operator by an interlocking device which prevents the withdrawal of the breaker while in the operating position. Live parts are not accessible while in the housing.

From the illustration above you'll recognize other important elements in the design and construction of this equipment. Better yet—write today on your Company letter-head for a copy of the R-S Loose Leaf Data Book — a reference book valuable to every central station or industrial power plant executive.

## A Few Interesting Items from the ROLLER-SMITH Line of Apparatus

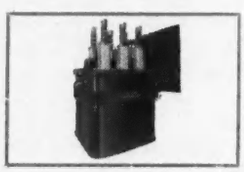


INSTRUMENT and CONTROL SWITCHES

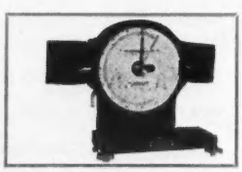


STEEL-SIX VOLTMETER

CIRCUIT TESTERS



50 TC BREAKER



PRECISION BALANCES

*Electrical Measuring and Protective Apparatus*

ROLLER SMITH

**ROLLER-SMITH COMPANY** BETHLEHEM, PENNA.

Switchboards • Metal Enclosed Switchgear • Electrical Instruments
Indoor and Outdoor Oil Circuit Breakers • Air Circuit Breakers

# 5 KVA VARIAC

You may need this largest Variac for controlling voltage on motors, heaters, flood lights, transmitter tube filaments, rectifier systems, or process equipment. Wherever line voltage varies and operating voltage must be correct, you will find this manually operated, continuously adjustable autotransformer gives smooth control and good voltage regulation at high efficiency. Designed for circuits of moderately high power, the Type 50 Variac is rugged, dependable and convenient.

Prompt delivery can be made on priority rating of A A 3 or better.

## TYPE 50 VARIAC SPECIFICATIONS

**Input Voltage:** Type 50-A, 115 volts, and Type 50-B, 230 volts.

**Output Voltage:** Voltages up to 117% of line voltage can be obtained. Connection can also be made for maximum output voltage equal to line voltage.

**Load Rating:** 5 kva for the 115-volt model; 7.5 kva for the 230-volt model. Ratings are for 50° C. rise.

**Rated Current:** 40 amperes.

**Maximum Current:** 45 amperes.

**Regulation:** At output voltages ranging from 17% below to 17% above line voltage the full load regulation is less than 4%.

**Losses:** No load losses are about 1% of full-load power; full-load losses are about 2%; losses at half maximum output voltage are about 4%.

**Driving Torque:** From 1 to 2 pound feet.

**Net Weight:** 85 pounds.

**Dimensions:** Approximately 12 inches high x 16 inches diameter overall.

**Price:** $100.00 F. O. B. Cambridge.

**SEND FOR BULLETIN NO. 857**

**GENERAL RADIO COMPANY**
**Cambridge, Massachusetts**
NEW YORK LOS ANGELES


conversely, reduce it and so release transformer capacity, reduction in the personnel of the department has curtailed their effectiveness. The letter, therefore, is supplemental to their personal work.

Customer demand is likewise another check, though with a lag in the case of added load which may do damage—somewhat like locking the stable door after the horse is stolen.

Since the letter went out, J. C. Plankinton, assistant general manager, reports that a considerable number of telephone responses have been coming to him personally, as well as to others in the department. These have caused the change recently of several banks of transformers, resulting in a more complete use of equipment.

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## Used Appliance Pool Sought by Utility

In hope of obtaining maximum use of available household appliances the Connecticut Light & Power Company, Waterbury, has announced a plan under which unused devices of this type may be pooled for early distribution. The company believes that many persons at present owning electric refrigerators, ranges, water heaters and smaller equipment, who, because of changed home conditions due to war have placed such appliances in storage or discontinued their use, may be willing to sell them to enable those badly in need of such service to carry on properly the essential work of maintaining a home.

There is no WPB regulation prohibiting the sale of used appliances, and if those having unused devices are willing to sell them for a reasonable price, it is believed that in this way a very important service will be rendered to the home front. The utility announced on the back cover of its February issue of "Connecticut Light News" that the C.L.&P. company or any appliance dealer will gladly list the name of any such owner and endeavor to find a buyer for his equipment, provided it is in good condition. Persons in need of such appliances are also asked to register their names with the company or dealers, including a list of the appliances they desire to obtain.

# Can the oil in your turbines match this performance?

**IOWA POWER & LIGHT CO.**
Des Moines, Iowa

| | |
|---|---|
| **Type of Turbine—** | 35,000 kw. generator |
| **Placed in Service—** | November 25, 1938 |
| **Original filling—** | 4,400 gals. |
| **Make-up oil—** | 300 gals. |
| **Steam temperature—** | 925° F. |
| **Steam Pressure—** | 1,290 lbs. per sq. in. |

Sample taken from system on February 22, 1943 (after 30,096 hours of continuous operation), analyzed and certified by competent testing laboratories, showed no significant oxidation or change in color. See photos and analyses at right!

**Certified Proof of the Superior OXIDATION STABILITY of Shell Turbo Oil**

| | | |
|---|---|---|
| **Color—N P A** | 1— | 1½+ |
| **Appearance** | Clear | Clear |
| **Water** | None | None |
| **Say. Univ. Vis. @ 100° F.** | 156 | 159 |
| **Neutralization No.** | 0.05 | 0.05 |
| **Saponification No.** | 0.1 | 0.1 |
| **S. E. Number** | 90 | 240 |

For further details on this and other outstanding performances of Shell Turbo Oil call in the Shell man. Or, write Shell Oil Co., Inc., Dept. "A," 50 W. 50th St., New York, N. Y., or 100 Bush St., San Francisco, Cal.

## SHELL TURBO OIL

SHELL

*Currently, the U. S. Navy has first call on Shell's entire production of marine turbine oil*

# NEW EQUIPMENT

## Voltage Tester

New voltage tester for maintenance work is equipped with 4 GE type NE-7 neon bulbs. It is said to automatically indicate: whether voltage is 110, 220, 440 or 660 volts; if current is a.c. or d.c.; if appliance or motor connected in the line is "open"; which leg is grounded; if frequency is 25 or 60 cycles; if fuse is blown; excessive leakage between a motor and a line.

Model "590" voltage tester; draws less than 1 milliampere of current; measures 1¾x5x1⅝ in., weighs 5 oz. **Superior Instruments Co.**, Dept. T, 227 Fulton St., New York, N. Y.

•

## Plastic Housing Drill

Field case, gear case and grip handle of new drill are made of "Thorite" plastic and slide into position over the metal skeleton frame. The housing does not support any of the operating parts of the device, but serves simply as a protective shell. Bearings, gears, center plate and other internal power unit parts are supported within the inner metal frame, which is said to insure close tolerance in alignment of these parts.

"Thor" electric drill, housed in plastic; available in three speeds, Model "U14K," 2,500 r.p.m.; "U13K," 3,750 r.p.m.; and "U12K," 5,000 r.p.m.; heavy-duty drilling capacity, ¼ in. **Independent Pneumatic Tool Co.**, 600 W. Jackson Blvd., Chicago, Ill.

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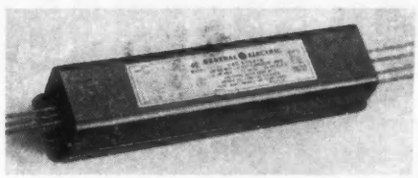
## Fluorescent Ballast



Three-lamp, 40-watt, high-power-factor ballast; designed to operate on lighting circuits of 110-125, 199-216, 220-250 and 240-280 volts; minimum power factor, 90 percent. **General Electric Co.**, Schenectady, N. Y.

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## Bushings

New line of bushings employs galvanized electric furnace annealed malleable iron flanges for use with currents up to 400 amp., bronze flanges for services above 400 amp. Made of porcelain, the bushings are tested under pressure for operation under either gas or oil conditions, it is said.

Dry type equipment bushings; for voltages from 7.5 kv. to 25 kv.; furnished in draw lead or fixed type terminals. **Porcelain Insulator Corp.**, 436 Main St., Lima, N. Y.

**BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.**

## Cable Connector

Quick-change connector for welding cables is used to extend short cables to parts of work. Tapered sleeve construction is said to make locking positive. A three-quarter turn in opposite directions connects or disconnects cable. No tools are required and there is no tape to wrap or remove. Highest possible conductivity is claimed. Clamp is said to eliminate possibility of shorting, fire hazards and damage to work or equipment. Manufacturer recommends connector for various types of cables used on supply lines, ships, electric railways and in mining operations.

Rapid cable connectors; Nos. 1, 1/0, 2/0, 3/0 and 4/0 cable sizes. **Chicago Tool & Engineering Co.**, 8345 S. Chicago Ave., Chicago, Ill.

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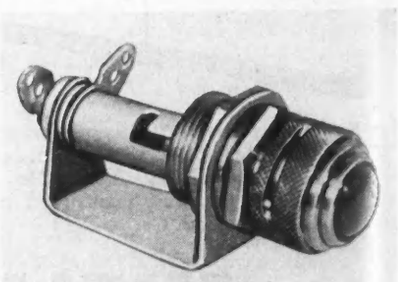
## Pilot Lights

Suited to applications where various intensities of light are desired under constantly changing conditions, new shutter-type pilot lights are said to permit a gradation of light from bright, through intermediate glows, to total dark with 90 deg. rotation of the shutters. Model 430 has faceted jewel, model 431 plain jewel.



"No. 430" and "No. 431" pilot lights, available with red, green, amber, blue or opal lens, also with polarized lens. **Gothard Mfg. Co.**, 1300 N. Ninth St., Springfield, Ill.

## —Like the HUBBARD AUTOGAP Lightning Arrester "Shoots Out" a follow-up arc

In Texas and other oil districts, when a well takes fire, a famous firm of oil field fire fighters is called in to extinguish the blaze. This is often accomplished by "shooting out" the blast after wreckage has been cleared and the fire confined to the smallest possible area, usually the jet emitted from the top of the casing. "Shooting out" consists of placing at the casing, a heavy charge of gelatinous nitroglycerine which, when exploded, destroys contact between the gases and the flames so that the continuous feed of combustible material to the point of ignition is interrupted. There is much more to the trick, but in principle, that is the process.

Hubbard *Autogap* Lightning Arresters employ exactly the same principle, but the "fire" in this case, is electrical, and the dissipating force is supplied automatically by the passage of the current through the arrester. When the current is forced around core "A" and through the minute clearances "B" to reach ground, the confinement and the contact with the fiber surfaces causes an explosion. The gases generated are exhausted simultaneously in opposite directions through vents. The follow-up arc is "shot out" just as the nitroglycerine explosion snuffs out a burning oil well.

For detailed data and diagrams write for an illustrated "Autogap" bulletin containing operating data, installation methods, results of tests and other pertinent information.

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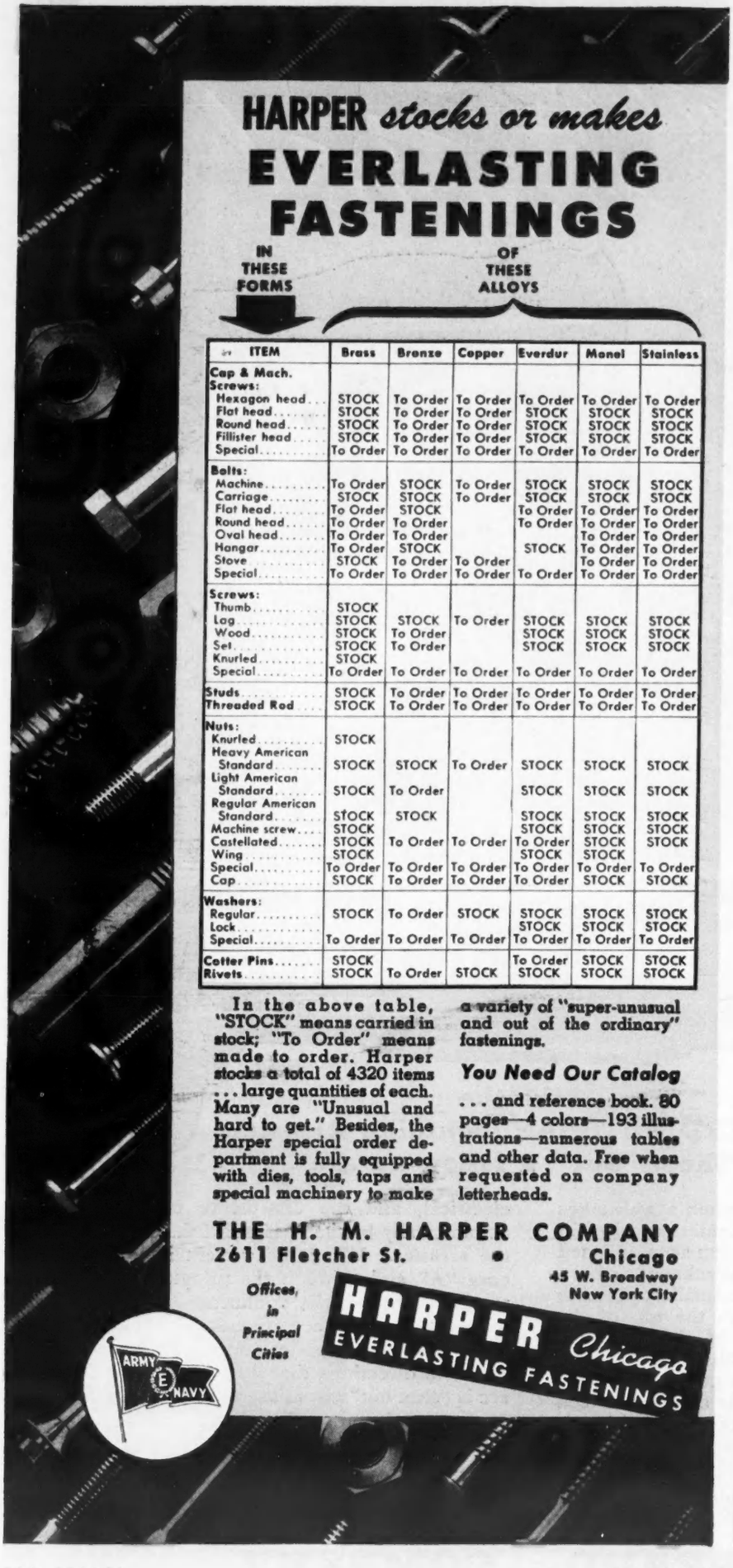

# HARPER *stocks or makes* EVERLASTING FASTENINGS

IN THESE FORMS — OF THESE ALLOYS

| ITEM | Brass | Bronze | Copper | Everdur | Monel | Stainless |
|---|---|---|---|---|---|---|
| **Cap & Mach. Screws:** | | | | | | |
| Hexagon head | STOCK | To Order | To Order | To Order | To Order | To Order |
| Flat head | STOCK | To Order | To Order | STOCK | STOCK | STOCK |
| Round head | STOCK | To Order | To Order | STOCK | STOCK | STOCK |
| Fillister head | STOCK | To Order | To Order | STOCK | STOCK | STOCK |
| Special | To Order | To Order | To Order | To Order | To Order | To Order |
| **Bolts:** | | | | | | |
| Machine | To Order | STOCK | To Order | STOCK | STOCK | STOCK |
| Carriage | STOCK | STOCK | To Order | STOCK | STOCK | STOCK |
| Flat head | To Order | STOCK | | To Order | To Order | To Order |
| Round head | To Order | To Order | | To Order | To Order | To Order |
| Oval head | To Order | To Order | | | To Order | To Order |
| Hangar | To Order | STOCK | | STOCK | To Order | To Order |
| Stove | STOCK | To Order | To Order | | To Order | To Order |
| Special | To Order | To Order | To Order | To Order | To Order | To Order |
| **Screws:** | | | | | | |
| Thumb | STOCK | | | | | |
| Lag | STOCK | STOCK | To Order | STOCK | STOCK | STOCK |
| Wood | STOCK | To Order | | STOCK | STOCK | STOCK |
| Set | STOCK | To Order | | STOCK | STOCK | STOCK |
| Knurled | STOCK | | | | | |
| Special | To Order | To Order | To Order | To Order | To Order | To Order |
| **Studs** | STOCK | To Order | To Order | To Order | To Order | To Order |
| **Threaded Rod** | STOCK | To Order | To Order | To Order | To Order | To Order |
| **Nuts:** | | | | | | |
| Knurled | STOCK | | | | | |
| Heavy American Standard | STOCK | STOCK | To Order | STOCK | STOCK | STOCK |
| Light American Standard | STOCK | To Order | | STOCK | STOCK | STOCK |
| Regular American Standard | STOCK | STOCK | | STOCK | STOCK | STOCK |
| Machine screw | STOCK | | | STOCK | STOCK | STOCK |
| Castellated | STOCK | To Order | To Order | To Order | STOCK | STOCK |
| Wing | STOCK | | | STOCK | STOCK | |
| Special | To Order | To Order | To Order | To Order | To Order | To Order |
| Cap | STOCK | To Order | To Order | To Order | STOCK | STOCK |
| **Washers:** | | | | | | |
| Regular | STOCK | To Order | STOCK | STOCK | STOCK | STOCK |
| Lock | | | | STOCK | STOCK | STOCK |
| Special | To Order | To Order | To Order | To Order | To Order | To Order |
| **Cotter Pins** | STOCK | | | To Order | STOCK | STOCK |
| **Rivets** | STOCK | To Order | STOCK | STOCK | STOCK | STOCK |

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COPPER and ALLOYS—A 385-page book gives in latest approved form, as of February 1943, all A.S.T.M. standards on copper and copper alloys covering cast and wrought material, alloys used for electrical conductors, and non-ferrous metals used in copper alloys. This book, "A.S.T.M. Standards on Copper and Copper Alloys," price $2.25 per copy, can be obtained from A.S.T.M. headquarters, 260 South Broad St., Philadelphia, Pa.

INCLOSED BUS SYSTEMS—Technical information, methods of estimating and layouts, suggested hangar arrangements, application data, together with descriptions and illustrations of bus ducts are contained in Bulletin 427 available from Bull Dog Electric Products Co., 7610 Jos. Campau Ave., Detroit, Mich.

NITRIDING FURNACES—A practical exposition of their constructional features, capacities, operation and instrumentation in four parts; the first describing types of furnaces, their designs and operating characteristics; the second the handling of ammonia; the third the determination of furnace sizes; the fourth instruments for operation. This book should be extremely useful to power salesmen and is available gratis from the Nitralloy Corp., 230 Park Ave., New York, N. Y.

MOTORS—For instruction to the operator in the care of his motor in order to lengthen its life, Bulletin 30, "The Care and Maintenance of Fractional Horsepower Motors," has been prepared by the Dumore Company, Racine, Wisconsin.

SELENIUM RECTIFIERS — Characteristics, circuits and output wave form of dryplate metallic rectifiers, ratings of rectifier plates, and other technical information is contained in Bulletin R-40, "B-L Selenium Rectifiers"; copy is obtainable from Benwood Linze Co., 1811 Locust St., St. Louis, Mo.

LIGHTING—How to care for your fluorescent installation and get maximum lighting from it are general subjects outlined in a booklet, "Timely Wartime Tips on Fluorescent Maintenance," obtainable from Lighting Division, Sylvania Electric Products, Inc., Salem, Mass.

WARTIME HOME LIGHTING—Booklet "How to Get More Light for Your Money" gives facts and suggestions on how to take care of household lamps and fixtures, in non-technical style for housewives. The illustrated booklet, No. A-4172, may be ordered from Westinghouse Lamp Division, price 2 cents each, f.o.b. Bloomfield, N. J.

WIRE—Properties, data tables, application and other data on magnet wire with Formex insulation are included in publication GEA-3911 obtainable from General Electric Co., Schenectady, N. Y.

PROTECTIVE LIGHTING—Intended as a guide for outdoor lighting an American war standard, "Protective Lighting for Industrial Properties," has been adopted by American Standards Association. The publication sets forth the principles involved, minimum degree of illumination, and chief areas to be lighted, and contains illustrations and tables. Copies at 50 cents each may be obtained from A.S.A. headquarters at 29 West 39th St., New York, N. Y.

VIRTUALLY every section of the country is dotted with American Bridge transmission towers — over 60,000 of them—carrying a large portion of the vital electrical energy that turns the wheels of America's war plants.

You don't hear much about these towers. The very fact that they stay out of the news is mute testimony of their year-after-year reliability. Utilities have learned to count on American Bridge towers as a means of assuring continuity of electrical service and low maintenance. And they have learned that these individually engineered structures serve equally well for transmission across difficult mountainous terrain, or over rivers, deserts and wide plains.

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UNITED STATES STEEL

# NEWS ABOUT PEOPLE

## Poston Succeeds Marr As Ohio Utility Chairman

Ben W. Marr has retired as chairman of the board of directors of the Columbus & Southern Ohio Electric Co., Columbus, Ohio, and John B. Poston, president, was named to serve also as chairman.

Mr. Marr joined the utility when it operated under the name of the Columbus Railway, Power & Light Co., was elected to the board of directors in 1919 and became a member of the executive committee in 1925. He was elected to the office of president and general manager four years later and in 1933 was also made chairman of the board. He retired as president last year, but continued in the capacity of chairman.

Mr. Poston was elected to the presidency last year when Mr. Marr relinquished the duties of this office. He first entered the utility field in 1914 with the Hocking Power Co., founded by his father, which was a predecessor company of the Southern Ohio Electric Co., later merged with the Columbus Railway, Power & Light Co. to form the present company. He was elected president of the Southern Ohio Electric Co. in 1934, after serving several years as its general manager. In 1931 Mr. Poston became a director of the Columbus Railway, Power & Light Co. and was made its executive vice-president the following year, continuing in that capacity after the two companies were merged in 1937 into the Columbus & Southern Ohio Electric Co.

•

▶ NORMAN FRANKS, manager of the Toronto district office of the Canadian General Electric Co., has been elected president of the Electric Service League of Toronto.

▶ P. E. WIDSTEEN, for the past 20 years in charge of electrical construction and maintenance of power plants and substations, meter and service shops for the Wisconsin Michigan Power Co. at Appleton, Wis., has been named superintendent of the water and light plant at Menasha, Wis., succeeding J. H. KUESTER, resigned.

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## Arrow-Hart & Hegeman Elects New Officers

Haynes L. Everest and Percy C. Smith have been elected vice-presidents of Arrow-Hart & Hegeman Electric Co., Hartford, Conn. Mr. Everest entered the H & H predecessor company's employ in 1907 and served as its western manager until called to Hartford in 1919 as general sales manager. He has been sales manager of the united organization since its formation in 1928 and has been active in the National Electrical Manufacturers Association.

Mr. Smith joined the H & H company in 1916 and on its merger with the Arrow Electric Co. was made head of the industrial division, in charge of development and sales. In 1937, as director of engineering, he took over supervision of the engineering, testing, tool and drafting activities of the Arrow-Hart & Hegeman Company.

•

▶ RAY M. HUDSON, for the past 14 years industrial executive of the New England Council, Boston, and widely known in utility circles in the northeast, has been appointed New England Regional Deputy Director for resources and materials and will head the WPB's regional labor, production, power, salvage and available inventory divisions with headquarters at Boston. For some months Mr. Hudson has been devoting part time to WPB work at Boston. JOHN D. WEST, until recently New England district manager for the Monroe Calculating Machine Co., will take over Mr. Hudson's work at the council for the duration.

## A.S.A. Elects Four New Members to Board

American Standards Association has announced the election of four new members to its board of directors. They are J. T. Barron, vice-president Public Service Electric & Gas Co., Newark, N. J., nominated by the American Institute of Electrical Engineers; C. A. Gill, vice-president Reading Co., Philadelphia, Pa., nominated by the Association of American Railroads; Robert G. Griswold, president Electric Advisers, Inc., New York, nominated by the American Gas Association, and Alvah Small, president Underwriters' Laboratories, Inc., Chicago, Ill., nominated by the National Safety Council.

•

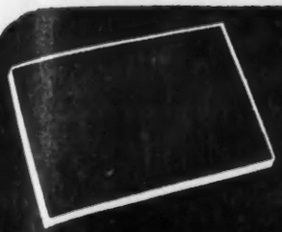
▶ H. J. UNDERHILL, vice-president Superior Water, Light & Power Co., Superior, Wis., has been appointed a member of the new Wisconsin Council of Defense by Governor Goodland.

▶ DR. SANFORD A. MOSS of Lynn, Mass., 70-year-old General Electric engineer, who pioneered the turbo-supercharger which gives flying fortresses and other American war planes power at high altitudes, recently received the honorary degree of doctor of laws from the University of California, where he worked his way as a student fifty years ago.

▶ G. B. KERSEY, supervising field engineer, Commonwealth Edison Co., Chicago, has retired after 38 years of service. After entering the operating department in 1905, Mr. Kersey transferred to the engineering department in 1907 and became a field engineer in 1922. He was made supervising field engineer in 1932 and for many years has taken an active part in fire protection schemes as applied to electrical installations at generating and distributing stations. Mr. Kersey has been succeeded by C. R. CAMP, who joined the company at the Fisk station in 1915,

# FROM *Mica Headquarters*

## 8 answers TO YOUR INSULATION PROBLEMS



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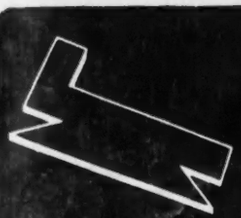
We carry molds for many standard types of commutator rings, can make immediate quotations. For estimates on special types, send sketch or dimensions.



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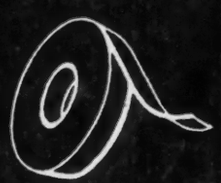

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Round, oval, square, rectangular and special shaped washers or pieces for insulating arc lamps, grid rheostats and similar apparatus.

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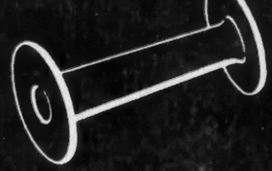

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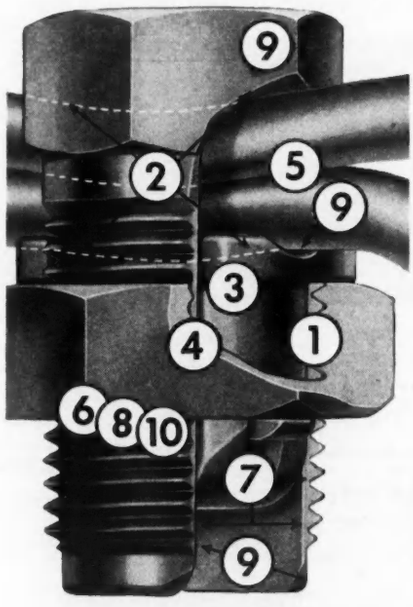


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transferred to the drafting room in 1918 and has been a field engineer since 1927.

▶ RALPH MYERS, who has engaged in distribution and other phases of electrical engineering for the Public Service Co. of Indiana, Inc., for several years, has been appointed assistant chief engineer.

▶ OTTO OLDEN, chief hydraulic engineer of the Hydro-Electric Power Commission of Ontario, was elected president of the Royal Canadian Institute at the annual meeting in Toronto.

▶ S. A. WORLEY, formerly manager of the Central Power & Light Co. at Rocksprings, Tex., has been appointed manager for that utility at Brackettville. Mr. Worley succeeds C. L. ST. JOHN, who has resigned to enter government service. G. C. HARBERT, formerly of San Benito, has been appointed manager in Rocksprings to succeed Mr. Worley. Mr. Harbert has been connected with Central Power & Light in the Rio Grande Valley for the past 18 years.

▶ JOHN C. HAMMER, former McMinnville attorney, has been appointed by Governor Cooper of Tennessee to membership on the state Railroad and Utilities Commission to serve during the absence of Commissioner William D. Hudson, now in military service. Since 1939 Mr. Hammer has been supervisor of the commission's motor carrier division. He is a former member of the state legislature, serving in the lower house of the 1937 general assembly as Warren County representative.

▶ PAUL E. QUINN, who has been local manager for the Public Service Co. of Indiana at Corydon for the past ten years, has recently succeeded R. B. Pearson as district manager at Mitchell. Mr. Pearson has entered military service. F. R. CHURCHILL, local manager at Marengo, has been transferred to Corydon, assuming the duties of district manager there. At the time of the appointments the company announced that the Marengo office would be closed and that all operations in that community and adjacent territory in Crawford and Harrison counties would be supervised from the Corydon district office.

▶ ARTHUR L. CLOUGH, Oklahoma City district manager for the Oklahoma Gas & Electric Co., has been promoted to southern division manager, succeeding HENRY E. BOWEN, resigned. Mr. Clough has been identified with Oklahoma Gas for 21 years. Mr. Bowen resigned as southern division manager to engage more directly in the war effort. He went to Ardmore as southern division manager in 1941, following five years as

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● The automatic guard adds immeasurably to the safety of this pole—the point is covered when not in use—completely guarded against damage. When in use, the tubular sleeve slides back and reenforces the head, adding to the service life of the pole.

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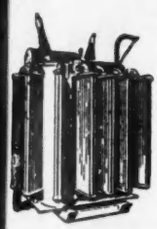

AmerTran power transformers available for all requirements in sizes to 10,000 KVA, 132 KV.

AmerTran distribution transformers of either oil- or noninflammable-liquid-immersed type available in sizes to 500 KVA., 72 KV.

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SOME day when we have fulfilled our Government obligations, we will be in a position to tell you fully the amazing story of the improvements that are being made in AmerTran products—today.

Today, wherever the new AmerTran products are being installed in connection with the war effort, electrical men are realizing that AmerTran is producing transformers that are *new* —new in electrical design, new in mechanical features, new in efficiency and economy.

True, we have placed entirely at the disposal of the Government and customers with high priorities our new and greater plant capacity. But, as for the past 42 years, we are still glad to extend to you, without obligation, the advice of AmerTran Engineers to help you secure the best results from your present equipment, to help solve today's problems of operation and maintenance, and to plan for your future needs in transformers for all utility and industrial applications.

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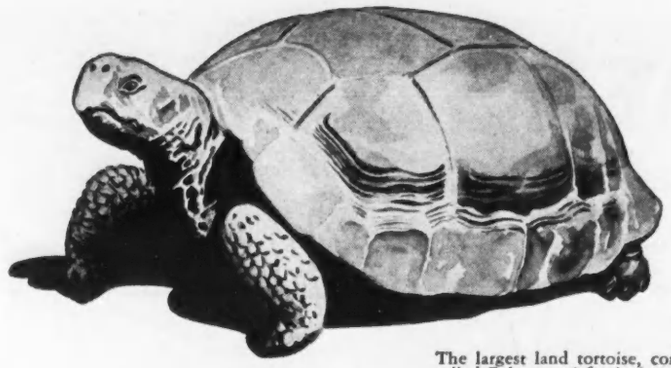

The largest land tortoise, commonly called Galapagos (after its home in the Galapagos Islands) lives, sometimes, in excess of 100 to 150 years.

# Even if he lives to be 175...A Hemingray Glass Insulator Can *Outlive Him*

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## 30 Hemingrays Ready to Solve Your Inter-Plant Problems

**10 Hemingrays for Primary Power Distribution**

From this group you can choose Insulators with the following range of characteristics:—

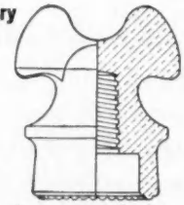
• *Critical Impulse Flashovers* ranging from 75 to 120. • *Leakage Distances* ranging from 4 to 9½ inches. • *Dry Arcing Distances* from 2⅜ to 4⅝ inches. • *Wet Arcing Distances* from 1 to 1¾ inches.

**5 Hemingrays for Your Signal Work**

From this group you can choose Insulators with the following range of characteristics:—

• *Heights* ranging from 3-13/32 to 4 inches. • *Diameters* ranging from 2¼ to 3¼ inches. • *Groove Diameters* ranging from ⅜ to 11/16 inches. • *Thread Diameters* standard at 1 inch in all 5 numbers.

**10 Hemingrays for Secondary Power Distribution**



From this group you can choose Insulators, Knobs and Spools with the following range of characteristics:—

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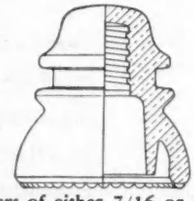
**7 Hemingrays for Telephone and Telegraph**



From this group you can choose Insulators with the following range of characteristics:—

• *Heights* ranging from 2-13/16 to 4-9/32 inches. • *Diameters* ranging from 2-7/16 to 3¾ inches. • *Groove Diameters* of either 7/16 or ⅜ inches. • *Thread Diameters* standard at 1 inch in all 7 numbers.

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# OWENS-ILLINOIS

**HEMINGRAY DIVISION • MUNCIE, INDIANA**

**HEMINGRAY Power, Telephone and Telegraph Insulators**


manager of the northern division. Starting with the company in 1921 as an electrician's helper, he served in a number of towns and a variety of capacities. LEO C. O'BRIEN, for the past 16 years auditor of the western division, has been made manager of the Oklahoma City district. Mr. O'Brien has been continuously connected with Oklahoma Gas since 1915, with the exception of time spent in the Army during World War I.

▶ JOSEPH D. LAWRENCE has been appointed district manager of the Logan district in the Huntington division of the Appalachian Electric Power Co. at Logan, W. Va. Mr. Lawrence has been connected with the Appalachian Electric Power Co. since 1923 and has been district manager of the Williamson district for the past 14 years.

▶ ASH WOOD, sales manager at the El Monte, Calif., plant of Littelfuse, Inc., and GERALD E. SPATES, general manager of the Chicago plant, have been elected vice-presidents of the company.

▶ A. C. HENRY, vice-president of Montreal Light, Heat & Power Consolidated, has been appointed president of the newly created Defense Communications, Ltd., a Crown company formed to coordinate "certain telegraph, telephone and other communications systems in Canada on behalf of the armed forces, and to provide additional equipment for such systems."

▶ DR. CHARLES M. SLACK, research physicist, has been appointed assistant director of research at the Westinghouse Lamp Division, Bloomfield, N. J. Dr. Slack is well known in the field of electronics research. In his new position as assistant to Dr. Harvey C. Rentschler, research director, Dr. Slack will direct experimental work on various lamp and electronic problems. Additional responsibilities also have been assigned to DR. JOHN W. MARDEN, who has been assistant director of research for the past 15 years. Although continuing in his present position, Dr. Marden will assume complete charge of metals research, an activity which has expanded greatly since the outbreak of the war.

▶ WILBUR L. YOUNG has been appointed manufacturing engineer of the turbine and gear departments of the General Electric Co. at Lynn, Mass. He is a native of Roanoke, Ind., and joined the company at Fort Wayne, Ind., in 1913. From 1919 to 1923 he was in charge of electrical installation work at the Fort Wayne plant, and from 1923 to 1928 was assistant electrical engineer of the building and maintenance department. He was later superintendent of the transformer department. In 1931 Mr. Young was transferred to the Pittsfield,

Mass., works and was assigned to plant organization work, later being made manufacturing engineer of the distribution transformer division and in December, 1942, manufacturing engineer of Pittsfield's East Plant No. 1. He transferred to Lynn on March 1 of this year.

▶ ELLIS F. BRACKEN, engineer of maintenance, substation department, Commonwealth Edison Co., Chicago, has retired after 42 years of service. He has been succeeded by J. S. WAY, formerly supervisor of storage batteries.

▶ CHARLES M. STEWART, superintendent of the municipally owned electric power plant at Murray, Ky., has resigned to join the Farmers' Rural Electric Co-operative Corporation at Glasgow, Ky., in the same capacity. Mr. Stewart was connected with the Murray electrical properties when the Kentucky-Tennessee Light & Power Co. operated them.

▶ LEWIS W. BAILEY, formerly editor of the Dallas *Journal*, has joined Dallas Rupe & Son, Dallas, Tex., investment bankers, as vice-president in charge of advertising and public relations. Dallas Rupe & Son have participated in the financing of a large number of enterprises in the Southwest and participate in the management of a number of these organizations. Among these are the San Antonio Transit Co., of which D. Gordon Rupe, Jr., is president and which operates the San Antonio bus system. The Rupe corporation has also assisted recently in the reorganization of the Louisiana Public Utilities Co., and participates in the management of its properties, which serve some 200 towns in Louisiana with electric power, water and ice.

▶ HARRY J. BILLICA has joined the sales organization of the Copperweld Steel Co., Glassport, Pa. He was formerly senior industrial specialist in the Office of War Utilities, WPB, in Washington, D. C. Before his association with WPB Mr. Billica was sales engineer for the Indiana Steel & Wire Co. and prior to that was associated with Graybar Electric Co. as Pacific district line material manager.

▶ RAYMOND W. KELLER, formerly vice-president and assistant general manager of the Milton Bradley Co., has joined the staff of Landers, Frary & Clark, New Britain, Conn. Mr. Keller has had many years of experience in engineering and industrial management. His new duties will be to assist R. L. White, president, and to study economic and industrial engineering problems. Graduating from the University of Minnesota in 1925, Mr. Keller received a B.S. degree in engineering. Later he took a

# Recovery Complete

The scarcity of new tools for civilian use grows increasingly acute. The only answer to this emergency shortage is to properly care for the tools we have and to repair potentially useful tools that have been discarded. Millions of dollars worth lie rusting in cellars, workshops and factories. Most of these could be put back to work for a fraction of their original cost. Most of these tools are of good quality and are simply the victims of carelessness or abuse. To put them into good working condition would cost on the average not more than one-fourth of their original cost. Repair parts are available. In many cases, no parts are needed or by combining parts from several tools a completed working tool will result.

Efficient, workmanlike tools are vital weapons of defense on the home front. Let's put our discarded tools back to work, while we can. We are going to need them desperately. Neglect now means deprivement later.

H. K. PORTER, INC., manufacturers of metal cutting tools since 1880, offer a practical booklet on the use, maintenance and repair of Porter HKP Cutters and other types of small tools. Send for your copy now. All Porter tools are precision built and like parts are interchangeable.

Army-Navy "E" awarded to our Men and Women for Excellence in War Production.

**H. K. PORTER, INC.**

**412 Ashland St., Everett, Mass.**

Without cost or obligation send me your booklet on the use, maintenance and repair of Porter HKP Cutters.

NAME.....

ADDRESS.....

RELIABLE CAN HELP YOU

SAVE TIME

in speeding the war program by using Reliable Straightline splices on new construction and on maintenance.

SAVE COPPER

by using these perfect joint making units over and over again.

RELIABLE

STRAIGHTLINE SPLICE

*Positive*

*Permanent*

*Low in Cost*

Reliable ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
1145 CARROLL AVENUE • CHICAGO ILLINOIS

post-graduate course in Business Administration, majoring in industrial management at the Harvard Graduate School of Business Administration.

▶ MARY J. STEWART has been appointed to serve as executive officer of the Air Conditioning and Refrigerating Machinery Association during the absence of William B. Henderson, executive vice-president, who has been ordered to immediate active duty as a Lieutenant in the U. S. Naval Reserve. Mr. Stewart has collaborated with Mr. Henderson in association operation for the past ten years and is well known to industry members.

▶ S. CAPLAN, who for the past nine years has been associated as research chemist with the Harvel Research Corp., has become research manager and acting technical director of the Irvington Varnish & Insulator Co., Irvington, N. J. Mr. Caplan succeeds C. F. HANSON, who has been appointed chief consulting engineer and will be responsible for expediting technical work on war production.

▶ R. W. BEARD, who formerly handled planning and execution of the General Electric Co.'s federal and marine program in the San Francisco territory, has been named assistant to the manager of the company's lighting division in Schenectady, N. Y. From 1925 to 1928 Mr. Beard served as arc welding and industrial heating specialist in the San Francisco Bay area. In 1928 he became associated with industrial equipment sales. Later in this connection he was instrumental in the promotion of sodium vapor lighting for the San Francisco Bay Bridge and the Golden Gate Bridge. He also was associated with A. F. Dickerson, manager of the company's lighting division, in the planning of decorative lighting for the Golden Gate International Exposition.

## OBITUARY

### H. F. T. Erben

H. F. T. Erben, retired manager of the Schenectady plant of the General Electric Co., died in that city on April 8, in his seventy-eighth year.

Mr. Erben started as an employee of the Edison Machine Works in Schenectady, predecessor of General Electric, in 1887. Following the growth of the company and the subsequent developement of the plant, he was made designing engineer of the direct-current department soon after the formation of the General Electric Co. in 1892. Advancing consistently, he was appointed plant manager at Schenectady in 1920. In 1924 Mr. Erben was named assistant vice-president, the position he held until his retirement in 1928.

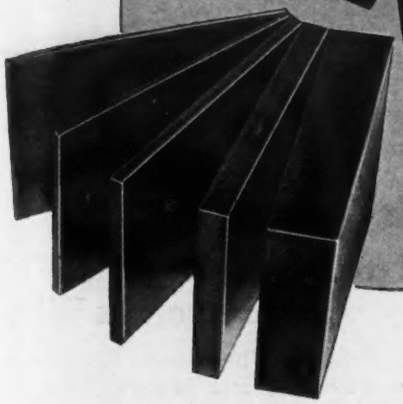
▶ H. B. MAYNARD, assistant secretary of the Iowa Public Service Co., died on March 23 at Waterloo, Iowa, at the age of 84. Mr. Maynard had been associated with the utility and predecessor companies for 37 years.

▶ WILFRED C. CORNU of Atlanta, Ga., who was connected with Templeton, Kenly & Co., Chicago, since 1922, died on March 6, at the age of 44.

▶ FRANK B. PARISH, for the past 16 years manager of the Alexandria (Ind.) district of the Indiana General Service Co., died recently. He was a native of Shelbyville, Ind. Mr. Parish was 60 years of age.

▶ ROLLO APPLEYARD, cable engineer, physicist and inventor, died at his home in London, England, on March 1, at the age of 76. His greatest engineering accomplishment was said to have been in connection with the Pacific cable between San Francisco and Honolulu. Mr. Appleyard invented a meter for the measurement of electrical conductivity and various aeronautical and other instruments. He did research in dielectrics, alloys, thermometry and surface tension. He was the author of "The Conductometer and Electrical Conductivity," "A Tribute to Michael Faraday," "Charles Parsons—His Life and Work," "The History of the Institution of Electrical Engineers, 1871-1931," and of many articles on engineering subjects.

▶ HORACE E. SHEDD, 78, retired safety director for the Appalachian Electric Power Co., Kentucky and West Virginia Power Co. and the Kingsport Utilities Co., died suddenly on March 18 at his home in Bluefield, W. Va. Mr. Shedd retired from active service after spending 30 years with the Appalachian Electric Co. He entered the utility as chief engineer of a municipal electric street lighting plant in Elgin, Ill., in 1892. Following a connection with the Niagara Falls Hydraulic Power Co., Niagara Falls, N. Y., he spent several years with the General Electric Co., which sent him to California as superintendent of some electric construction work. He then affiliated himself with the Great Western Power Co., San Francisco, in the capacity of superintendent. When this company sold its interests, Mr. Shedd joined the Appalachian Power Co. as general construction superintendent of high-tension lines and substations, and had continued his activities with this company, now Appalachian Electric Power, for 30 years. For the last twelve years of his service with the company he had been safety director. He had been active in state, county and national traffic, home and industrial safety work for a number of years.



# You MAY FIND LIGNOLITE

A LAMINATED LIGNIN

## PLASTIC

FOR ELECTRICAL INSULATION . . . .

# . . . . An immediate Answer to your Problem . . .

• If you are interested in a material that will give you dependable, permanent electrical insulation and that you can GET IN ANY QUANTITY for IMMEDIATE APPLICATION, we suggest that you try LIGNOLITE.

If your application requires an insulating material with HIGH MECHANICAL STRENGTH—EXCELLENT ELECTRICAL PROPERTIES — LOW MOISTURE ABSORPTION — HIGH RESISTANCE TO OIL, GREASE, AND DILUTE ACIDS—HIGH DIELECTRIC STRENGTH — HIGH STRENGTH-WEIGHT RATIO—or with SUPERIOR ARC RESISTANCE, you have a positive and permanent answer in LIGNOLITE.

LIGNOLITE is available in black color with either a satin or molded sand blast finish. The following sizes are now produced; 46-inch x 46-inch and 28-inch x 72-inch sheets in thicknesses from 1/64-inch to 5/8-inch inclusive and 40-inch x 40-inch sheets in thicknesses of 5/8-inch to 2-inch inclusive. Also available: fabricated parts to your specifications.

**NON-CRITICAL**

**PROMPT SHIPMENT**

### Suggested uses for LIGNOLITE

Use LIGNOLITE for Clamps and Supports for Busses in Metal Clad Switchgear—Circuit Breaker Bases—Switch Connectors—Insulating Supports—Relay Bases—Switchboards—Panel Boards—Spool Heads—Insulating Washers—to replace Steel in Metal Clad Switchgear—Cabinets to house Electrical Equipment—Name Plates for Electrical Equipment—Terminal Strips, etc.

**To get sample of LIGNOLITE**

*Simply Fill in and Mail Coupon*

**MARATHON CHEMICAL COMPANY**
**ROTHSCHILD, WISCONSIN**

☐ Please send me a sample of LIGNOLITE and Bulletin containing specifications and test data.

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*Div. of Marathon Paper Mills Co.*
*Rothschild, Wisconsin*

# MANUFACTURING-MARKETS

## Bid Business Aid U. S. in Post-War Plan

American industry should submit to the government information on its position in the post-war period, so that the government "can establish a realistic plan of its functions in post-war matters," Herman L. Hirt, assistant to the president of International General Electric Co., stated at a recent conference of the Export Managers Club at the Hotel Pennsylvania, New York.

On the basis of such information, the Government "should be able now to determine in principle the rate of demobilization of our armed forces, tax rates for corporations and individuals, and the approximate date when government controls on prices, production and rationing can and should be relaxed without danger of inflation or hardship to the public."

Mr. Hirt pointed out that at present there were at least 300 private business organizations which have established post-war planning committees. Such groups, for the most part, he said, "are trying to determine the reserves they need to set up at the present time for conversion from wartime to peacetime manufacture; the public demand for their respective manufactured products, including the purchasing power of the public; the rate of re-employment during and after conversion, and the total number of employees required for their respective operations, including an estimate of additional employees for new products."

•

## Philco Organizes Unit to Handle Export Sales

With a view to laying the groundwork for the further expansion of its export business in the post-war period, Philco Corp. by agreement with American Steel Export Co., Inc., has formed the Philco International Corp. with offices in New York, to handle sales of Philco products in all countries outside the United States, Larry E. Gubb, chairman of the board of directors of Philco, and Howard W. McAteer, president of American Steel Export Co., Inc., have announced.

Officers of Philco International Corp. will include Larry E. Gubb, chairman of the board of directors; Dempster McIntosh, New York City, president; John S. Haber, New York City, vice-president, and William R. Wilson, treasurer of Philco Corp., treasurer.

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## Orders Make Record, Net Dips in 1942

Canadian General Electric Co. has reported that the 1942 volume of orders received and production were the largest in the company's history, being substantially higher than in 1941, the previous record year. But, with the company's greatly expanded operations devoted almost entirely to war purposes, operating profits declined and there was a moderate decline in net profits.

Net profits for the year amounted to $2,327,452, equal to $11.71 a common share, after preferred needs, compared with $2,479,556 in 1941, equal to $12.57 a share.

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## All-Out War Production

D. J. O'Conor, president of Formica Insulation Co., stated at the recent annual meeting of stockholders that "we have completed conversion to an all-out war production, with between 80 percent and 90 percent of our output going to the Army Air Forces, and we are rapidly approaching the limit of plant capacity," but, he explained, "we are also looking forward to the post-war market."

## Lower Net Reported by Anaconda Wire

Anaconda Wire & Cable Co. in a report for the year 1942 shows net profit of $1,427,408, after deducting a reserve of $6,000,000 to provide for possible liability for renegotiation, a provision of $7,260,000 for federal income and excess profits taxes after a post-war refund of $695,000 and a reserve of $300,000 for contingencies. This is equal to $3.38 a share, compared with $2,507,476, or $5.94 a share in 1941, when taxes amounted to $6,200,000 and the contingent reserve was $250,000.

Other manufacturing companies recently reporting earnings include the following:

PENN ELECTRIC SWITCH—For 1942, net profit, $357,857, equal to $2.98 a share on common stock outstanding compared with $251,564, or $1.91 a share in 1941.

FORMICA INSULATION—For 1942, net income, $847,717, equal to $5.17 each on 164,000 common shares, compared with $462,365, or $2.82 a share in 1941.

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## Artkraft Distributors

Artkraft Sign Co., Lima, Ohio, has announced that its product is now also available through the manufacturing and distributing facilities of the Edwin F. Guth Co. and the F. W. Wakefield Brass Co. The product of these companies will henceforth be known as the Guth-Artkraft Fixtures and Wakefield-Artkraft Fixtures.

•

## Canadian Battery Makers Form Association

Canadian battery manufacturers, representing over 90 percent of the production in the industry, at a meeting held in Toronto, formed an association to be known as the Association of Canadian Storage Battery Manufacturers.

*ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION*

# WESCO restored war plant 28 days faster

### *Beat Flood Damage by Prompt Service on 22 Electrical Products of 6 Manufacturers*

This factory, overwhelmed for 7 days by sudden winter floods, makes a weapon vital to our men in battle. Completely inundated, the manufacturing equipment and machinery were ruined for production. Facing an indefinite shut-down, the plant called the nearest Wesco House asking for 22 electrical products made by 6 manufacturers.

Wesco began immediate delivery of safety switches, fuse holders and mountings, links, fuses, tapes, wire and cable, and kept pace with the repair crews. This was a job only an Electrical Wholesaler could do. For the purchase of these 22 items direct from the manufacturers meant a delay of 4 weeks before the plant could get on with the war. The Works Manager wrote Wesco—

"On behalf of our entire organization, I wish to extend our sincere appreciation for the assistance rendered to us by your Company during our recent flood experience. We all feel your help contributed greatly to our ability to resume operations at an early date." The Wesco service that now speeds war production will someday win peacetime victories for American industry.

**WESCO SPEEDS WAR PRODUCTION**

* After five weeks of waiting for manufacturers' delivery of urgently needed floodlighting equipment for emergency airfields, the airlines company appealed to Wesco. The entire shipment was on its way in 18 days after Wesco received the order.
* A war plant was threatened with a production tie-up unless a critical product was obtained. 60 days was the best delivery promise of a manufacturer. Wesco made delivery in 24 hours!

**WESCO SERVES BUSINESS**

* By offering prompt delivery of electrical items from large stocks.
* By maintaining perpetual inventory stock records.
* By knowing local and national codes and rulings.

## Westinghouse Electric Supply Co.

150 VARICK STREET • • • NEW YORK, N.Y.

A NATIONAL DISTRIBUTING ORGANIZATION WITH 80 BRANCHES

## Manufacturers Make Sales Appointments

Electrical manufacturing companies have recently announced the following additions to their sales staffs:

Triangle Conduit & Cable Co., New Brunswick, N. J., has appointed John Cushman, Palm Beach, Fla., district representative for the state of Florida (east of Pensacola); John Naylor, New Orleans, La., district representative for the states of Louisiana, Mississippi, and the cities of Mobile, Ala., and Pensacola, Fla. Triangle Pacific Co. has named C. H. Kaufman, Los Angeles, Calif., district manager for the states of California (south of but not including Bakersfield), Arizona, Nevada (city of Las Vegas only); Rex Larsen, district manager, San Francisco, states of California (north of and including Bakersfield), Nevada (except Las Vegas), and Utah; Robert Sloane, district manager, Seattle, Washington, the states of Oregon, Washington, Idaho, and Montana (west of Billings).

Trumbull Electric Mfg. Co., Plainville, Conn., has appointed L. C. Watson New England district manager with headquarters at the Plainville factory. In addition to this assignment, Mr. Watson continues as special representative on motor control.

Wheelco Instruments Co., Chicago, has announced three additions to the sales and service staff. Hugh Acock, formerly in the Tulsa territory, has been named Texas district manager with headquarters in Houston. C. H. Garrison has been named Kansas City representative, with a territory including western counties of Missouri. Russell George has been added to the sales and service department of the company's combustion safeguard division, with headquarters in Chicago.

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## G.E. Product Service Made Division of A. & M.

Product service has become a division of General Electric Co.'s appliance and merchandise department and L. H. Taylor has been appointed manager of this division.

Product service of the appliance divisions at Bridgeport and of the air conditioning and commercial refrigeration divisions at Bloomfield become sections of the newly created product service division. W. C. Noll, Bridgeport, and R. U. Berry, Bloomfield, continue as managers of these respective sections.

Mr. Taylor, manager of the new division, has been with General Electric since 1925 and has been connected with the appliance and merchandise department since 1938.

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## Metco Moves

Announcement has been made that the Long Island City address of Metallizing Engineering Co., Inc., is 38-14 Thirtieth Street. This four-story building will be used to house Metco's home office, plant and eastern warehouse.

# Field Reports on Business

*Manufacturers of electrical equipment are booking small orders at a steady rate on apparatus with a wide diversity of application. Heavy industrial equipment is quiet. Small business and civilian service firms are retiring from the field in ever greater numbers. Retail sales throughout the country continue to shrink.*

### NEW YORK

WPB and OPA, working out a "profit-sharing" method in a "concentrated" industry—in this case alarm clocks—may be setting the pattern for the appliance industry. In the alarm clock business, out of six firms which produced clocks in the base period 1936-1941, probably only two will be permitted to make clocks henceforth. But all six will participate in the distribution of the clocks (which will bear no trade names). The clocks will be distributed through the manufacturers' customary outlets and each of the six companies will be allowed a supply proportionate to their base production. OPA will probably have a regulation out on the plan shortly.

Retail sales in the country continue to shrink in comparison with the corresponding week of a year ago. For the week ended April 3 department store sales dropped 7 percent over the '42 week, according to the Federal Reserve Board, following a decline of 3 percent the week previous. For the latest four-week period the sales were 2 percent under the four-week period last year. New York was off 11 percent for the latest week, Boston off 13 percent and Philadelphia 8 percent.

Civil engineering construction for the latest week totaled $93,841,000—62 percent under the corresponding week a year ago, according to *Engineering News-Record*. Volume for the month of March totaled $305,973,000—58 percent under March, 1942. The latest week's volume brings the total for 1943 to $994,271,000, which is 55 percent lower than the 15-week period last year.

### CHICAGO

The rapid transition of Chicago's war industries from the expansion to the production phase and the growing pressure that is forcing small businesses and civilian service firms from the field in ever-greater numbers were clearly reflected last week in statistics of electric utilities serving the Chicago area, as reported to stockholders of the Commonwealth Edison Co.

From December, 1941, to December, 1942, the percentage of output for electric light and power used for war production purposes in the Chicago area increased from 15 to 26 percent and estimates indicate that by next winter 45 percent of output sold to industry will be used for war production purposes. Paralleling this upward surge of energy used by war plants is an accelerating decrease in the sale of energy to small businesses. In 1942 the decline was 3.4 percent, but for the first two months of this year it was at the rate of 9.3 percent. Shrinkage is due largely to retirements from business of civilian service firms and the lack of materials and manpower for small shops and other war influences.

There is, however, some indication that temporary relief is in sight for some small manufacturing concerns in the Middle West. Small industrial firms in Illinois, Iowa, Indiana and Wisconsin will soon be given an opportunity to bid for a large part of orders totaling $75,000,000, which are part of $200,000,000 in Army orders recently allotted to small firms whose regular business has been curtailed by the war, it was announced in Chicago during the past week.

Chicago's two large mail order houses report that sales in March and for the first two months of their fiscal years, February and March, are off from comparable periods last year.

### NEW ENGLAND

New England manufacturers of electrical equipment are booking small order contracts at a steady rate. These are featured by wide diversity of applications in the electrical field. There is a strong demand for signalling and communication apparatus; manual transmitter system apparatus orders are being booked by a Massachusetts manufacturer, small switches and control are selling well, and portable electric tools are moving into shipyards and naval stations. A Connecticut manufacturer has tendered quotations on 2000 toggle switches and over 200 knife switches. A Massachusetts plant has bid on 2200 electric resistors and a specialist in sterilizing apparatus has submitted tenders for more than 200 110-volt type A water stills.

Heavy industrial equipment is quiet. Back-logs built up in shipyards are being pared down rapidly. As the locomotive requirements of new war factories are tapering off, older plants have an opportunity to bolster their heavily loaded motive power with new Diesel electric locomotives," declared F. H. Craton of the Erie Works, addressing sales engineers of General Electric in the New England district last week. War work opportunities amounting to $177,000,000 will be available soon to New England plants by the Army Quartermaster Depot, according to an announcement last week.

### PACIFIC COAST

The value of California manufactured products has increased from $2,800,000,000 in 1939 to $8,500,000,000 in 1942. The same period marked increases of 140 percent in personnel and 300 percent in payroll. This year, so far, has added 50 percent both in personnel and payroll to the 1942 average.

U. S. Engineers are surveying Clark's Fort of the Columbia River so as eventually to increase the power output of present and prospective generators of the Bonneville system. New housing projects cover large developments in Richmond, Seattle, and in various locations in Idaho.

Of considerably greater electrical significance in proportion to the material installed are several new private ventures, such as 145 five- or six-room houses at Redondo Beach, southern California; 239 houses to sell for $4,500 each in Vallejo, and 299 homes in Spokane to cost more than $1,500,000 in all, this last work being now actually under way.

Industrial developments include new mines, smelters and concentrating mills in a variety of places and with an average priority sufficiently high to insure considerable power apparatus business.

LAST YEAR'S BONDS GOT US STARTED

# THIS YEAR'S BONDS

# ARE TO WIN!

★ Last year saw nearly 30,000,000 workers voluntarily buying War Bonds through some 175,000 Pay-Roll Savings Plans. And buying these War Bonds at an average rate of practically 10% of their gross pay!

This year we've got to top *all* these figures—and top them handsomely! For the swiftly accelerated purchase of War Bonds is one of the greatest services we can render to our country . . . and to our own sons . . . and our neighbors' sons. Through the mounting purchase of War Bonds we forge a more potent weapon of victory, and build stronger bulwarks for the preservation of the American way of life.

"But there's a Pay-Roll Savings Plan already running in my plant."

*Sure, there is*—but how long is it since *you've* done anything about it? These plans won't run without winding, any more than your watch! Check up on it today. If it doesn't show substantially more than 10% of your plant's pay-roll going into War Bonds, it needs winding!

*And you're the man to wind it!* Organize a vigorous drive. In just 6 days, a large airplane manufacturer increased his plant's showing from 35% of employees and 2½% of pay-roll, to 98% of employees and 12% of pay-roll. A large West Coast shipyard keeps participation jacked up to 14% of pay-roll! You can do as well, or better.

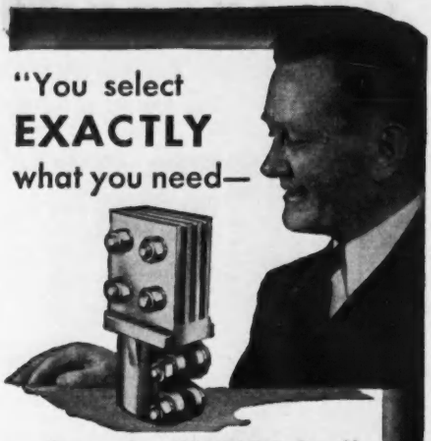
By so doing, you help your nation, you help your workers, and you also help yourself. In plant after plant, the successful working out of a Pay-Roll Savings Plan has given labor and management a common interest and a common goal. Company spirit soars. Minor misunderstandings and disputes head downward, and production swings up.

War Bonds will help us win the war, and help close the inflationary gap. And they won't stop working when victory comes! On the contrary—they will furnish a reservoir of purchasing power to help American business re-establish itself in the markets of peace. *Remember, the bond charts of today are the sales curves of tomorrow!*

## You've done your bit Now do your best!

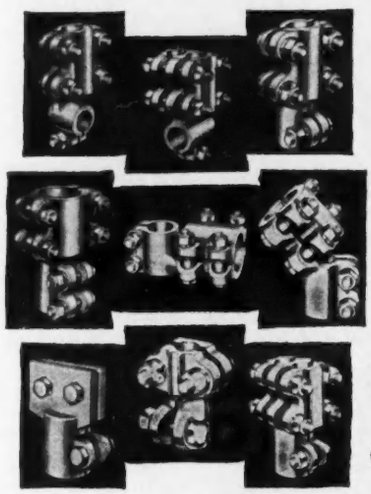
THIS SPACE IS A CONTRIBUTION TO AMERICA'S ALL-OUT WAR EFFORT BY
ELECTRICAL WORLD

"You select
**EXACTLY**
what you need—



— from the **COMPLETE** line"

**Stud Connectors and Solderless Terminal Adapters** for distribution and power transformers . . . for connecting to cable, pipe or bus bar . . . in line or at any angle. Connectors with reversible clamping caps take two different ranges of cable sizes. Furnished for any number of conductors. A few of Penn-Union's many types:



Also . . . the most complete line of Service Connectors, Cable Taps, Tees . . . Straight and Parallel Connectors . . . Bus Supports, Spacers . . . Grounding Clamps, Terminal Lugs, etc. etc.

Penn-Union conductor fittings are the first choice of leading utilities, industrials, electrical manufacturers and contractors—because they have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.* Write for Catalog.

**PENN-UNION ELECTRIC CORPORATION**
**ERIE, PA.** *Sold by Leading Jobbers*

**PENN-UNION**
Conductor Fittings

# Sales Opportunities

WISCONSIN—Wisconsin Electric Power Co., Milwaukee, plans extensions in transmission lines in three counties, including expansion and improvements in number of substations at various points. High-tension system will be extended for connection with transmission lines of Public Service Co. of Northern Illinois, for exchange of power. Project has been approved by State Public Service Commission and work is scheduled to begin at early date.

OHIO—Canton Drop Forging & Mfg. Co., Canton, plans plant for production for government, comprising several large buildings, with machinery and electrical equipment for extensive capacity. Cost about $4,000,000, with financing by Defense Plant Corp. Work will be placed under way soon.

WASHINGTON—War Department, Washington, D. C., has authorized expansion in air force base, comprising additional hangars, shops, warehouses and other structures, with installation of machinery and electrical equipment. Also will make extensions in barracks and other buildings, with additions to electrical distribution system and power substation facilities. Entire project will cost over $3,000,000 and will be supervised by District Engineer Office, Seattle.

PENNSYLVANIA—Owens-Corning Fiberglas Corp., Nicholas Building, Toledo, Ohio, plans plant for production for government, consisting of main building and auxiliary structures, with automatic machinery, electric furnaces and electrical equipment, estimated to cost about $1,600,000. Financing by Defense Plant Corp. Work is scheduled to begin soon.

MISSOURI—Laclede Rural Electric Cooperative, Lebanon, plans extensions in primary and secondary lines in two counties, totaling close to 100 miles, with power substation facilities and service connections. Work will be carried out in conjunction with acquisition of about 44 miles of similar lines heretofore held by Citizens Electric Co. of Missouri, to form part of Laclede system in future. Fund of about $216,000 is being secured through ERA for entire program.

CALIFORNIA—War Department, Washington, D. C., has approved plans for new army general hospital, comprising large group of one and multi-story buildings, with complete electrical equipment installation. Also power substation, air-conditioning system, refrigerating plant and system and other mechanical units. Entire project is estimated to cost about $3,000,000 and will be supervised by District Engineer Office, Sacramento.

FLORIDA—Navy Department, Washington, D. C., plans extensions in airport, including hangars, shops and other structures, with machinery and electrical equipment. Also will make additions to distribution system and power substation facilities. Appropriation of about $1,000,000 has been arranged for entire project. Work will be carried out at early date.

KANSAS—Panhandle Eastern Pipe Line Co., 1223 Baltimore Ave., Kansas City, Mo., operating natural gas transmission system, plans expansion in central booster station and plant, including installation of compressors and other equipment to increase capacity about 2,000-hp. Work will include a new water softener and cooling tower, remodeling of two existing water towers, installation of three new centrifugal pumps for water service, and other facilities. Work is scheduled to be carried out at once.

MICHIGAN—Bower Roller Bearing Co., 3040 Hart St., Detroit, manufacturer of ball and roller bearings, will carry out expansion in plant for production for government, including machinery and electrical equipment installation. Cost about $460,000, with financing by Defense Plant Corp.

KENTUCKY—War Department, Washington, D. C., has authorized expansion in army camp, including shops, warehouses and other industrial buildings, with machinery and electrical equipment. Also barracks and miscellaneous structures. Extensions will be made in electrical distribution lines and power substation facilities. Entire project is estimated to cost approximately $1,000,000, and will be supervised by District Engineer Office, Nashville, Tenn.

MISSISSIPPI—Water Department, Jackson, receives bids until May 4 for extensions in water system, including filter equipment, pumping machinery, chemical feed apparatus, etc. Entire project is estimated to cost about $300,000. A priority rating has been secured. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

CALIFORNIA—District Engineer Office, U. S. Army, 4792 Sepulveda Ave., San Bernardino, will make extensions in electrical distribution system in connection with new buildings at an air base, including equipment and facilities for light and power service. No estimate of cost announced.

MONTANA—Montana-Dakota Utilities Co., Minneapolis, Minn., plans extensions in primary and secondary lines, with service facilities for federal farms project, including power line for pumping station operation in the area. Priority rating is being secured and work is scheduled to begin soon.

NEW JERSEY—Otis Elevator Co., 260 11th Ave., New York, N. Y., plans expansion in plant for production for government, including new buildings and installation of machinery and electrical equipment. Cost estimated about $750,000, with financing by Defense Plant Corp.

IOWA—War Department, Washington, D. C., has approved plans for expansion of army general hospital, including new buildings, with complete electrical equipment and facilities. Also power substation expansion and distribution line extensions. Complete project will cost over $1,000,000 and will be supervised by District Engineer Office, Omaha, Neb.

KANSAS—Public Works Department, Wichita, receives bids until April 26 for pumping machinery, controls and auxiliary equipment for expansion in sewage treatment plant. Entire project will cost close to $246,000, with financing by federal aid. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers.

FLORIDA—Navy Department, Washington, D. C., plans expansion in naval air station, including hangars, shops, warehouses and other buildings, with installation of machinery and electrical equipment. Also extensions in barracks and miscellaneous structures, with additions to electrical distribution lines and power substation facilities. Entire project is estimated to cost about $1,885,000. Appropriation has been arranged and work will be carried out at early date.

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## BOOKS RECEIVED

**Elementary Electricity**—Revised, by Edgar P. Slack. McGraw-Hill Book Co., New York. 305 pages, illustrated. Price $2.

Free of anything but the simplest arithmetic, this rudimentary text, geared to pre-induction prescriptions, deals with d.c. and a.c. circuits and equipments as beginners previously exposed to physics need to be aided in approaching them. Due emphasis is given to operating technique.

**Alternating-Current Circuits.** By Earle M. Morecock. Harper & Brothers, New York. 175 pages, illustrated. Price $2.75.

A text of Rochester Atheneum and Mechanics Institute in elementary category accompanied by laboratory exercises and 188 simple problems with numerical answers. Trigonometric tables in appendix.

**Engineering Reports of the Joint Subcommittee on Development and Research**—Vol. V. Published by Edison Electric Institute, 420 Lexington Avenue, New York. 362 pages, illustrated. Price $10.

This is the fifth volume of reports prepared by EEI and Bell system representatives and comprises 11 reports (Nos. 39-49). Taken with the others it constitutes an authentic compilation and annotation of quantitative information which has progressed to the point where its application makes much field investigation of coordination problems no longer necessary. The present document treats power system fault-to-ground characteristics, rural power and telephone coordination, short-circuiting (telephone) relay protectors, Petersen coil grounding, bonding of telephone cables to power neutrals, use of neutralizing transformers, frequency weighting, subscriber set susceptiveness, wave-shape of multiphase rectifiers, low-frequency shielding in telephone cables and positive disconnection of distribution circuits during faults to ground. Needless to say, this newest volume should also be found on the reference shelves of every power company of any size that has lines in proximity to communication circuits.

**Economy Loading of Power Plants and Electric Systems.** By Max J. Steinberg and Theodore H. Smith. John Wiley & Sons, Inc., New York. 203 pages, illustrated. Price $3.50.

There are 31,713 ways in which ten boilers can be operated in combination with five turbines in a plant to carry imposed loads. Evidently the problem of getting maximum economy under a wide range of load conditions is as intricate (unless simplified) for a plant with small units as for a metropolitan station like that on which the authors are employed. Even when reduced to computable practicability the task is still not an elementary one. It is shown that the incremental rate is the crux but not the panacea. For the boiler and the turbine there is ample mathematical and graphical discussion of the corrections for banking, steam temperature, auxiliary power, fuel price, feedwater temperature in connection with load-division guides and sequence of adding units. Computation and adjustment of over-all station performance curves follow and then the same principles and techniques are developed for the most appropriate sequence of addition or removal of units on an interconnected network of stations or systems. Shorter discussion of superposed and industrial turbines rounds out this well-organized and lucid discussion of an obscure but highly important topic.


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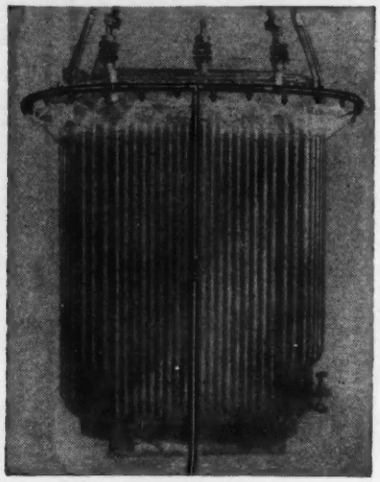

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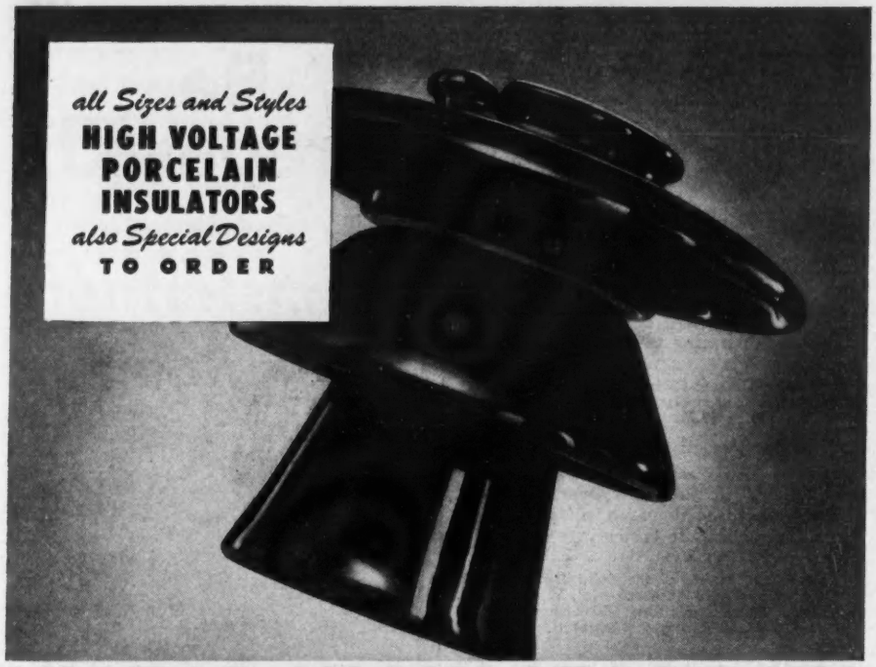


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## Recent Legislation

Various state legislatures have taken action on many new measures, affecting the electric light and power industry.

ALABAMA—Interim judiciary committee has approved certain changes in utility laws recommended to it earlier by Gordon Persons, member of the state Public Service Commission. One would give the commission authority to regulate rates and practices of certain utilities, serving tenants. Mr. Persons stated that between 17,000 and 20,000 Alabama homes are now served by textile mills and that the commission, under present law, has no jurisdiction over rates and regulations applicable to them. The commissioner said most mills charged their tenants reasonable rates and it was not the purpose of the commission to interfere but that it did want to be in a position to investigate complaints and correct inequalities in some few cases.

ARIZONA—Revised water and power authority bill passed the Senate, 13 to 5, recently and was sent to the House, where a duplicate measure already was on the committee of the whole calendar. It was a substitute for the Governor's bill and was adopted after a long and bitter fight. Although it agrees with the Governor's bill in many respects, it would limit the power of the agency created to such activities as planning, investigating, and contracting for power and water, and would greatly reduce the amount of money to be made available for the agency's use. Authority proposed in the Governor's bill to build power lines and canals, put the state in the power business, issue revenue bonds and impound the $300,000 which Arizona receives annually from Boulder Dam power, is denied under the revised act. Principal duties of the agency as defined in the bill are to plan "for the use of and for control and supervision of the water and power which the authority may acquire by contract for the state from the Federal government from the main stream of, and from the power-producing works on, the Colorado River." The bill appropriated $15,000 for use of the agency for the remainder of the current fiscal year, $50,000 a year for the next biennium and $12,500 annually for the biennium, to be matched by Federal funds for water and power surveys. It would abolish the Arizona Colorado River Commission to avoid duplication of authority.

CONNECTICUT—Bills making provision as follows were unfavorably reported in the state legislature recently by the judiciary committee and tabled for the calendar: SB 6, making the state public utilities commissioners elective officers; SB 113, requiring the public utilities commission to mail notices of all hearings on rate increases to all property owners in area affected; SB 706, requiring the commission to establish rates based on fair rate of return to investors on capital prudently invested; SB 708, empowering the commission to make summary investigations of rates and service; SB 718, providing for the holding of commission hearings in the town whose residents the hearing affects. A favorable report was made on SB 723, providing rates and service of publicly owned utilities outside the limits of the towns owning them shall be subject to the commission.

MARYLAND—Bill has been introduced in the Legislature to make a change in the taxation of public utility corporations. The measure would eliminate the present full rate taxation of the capital stock of the corporation and substitute therefor taxa-

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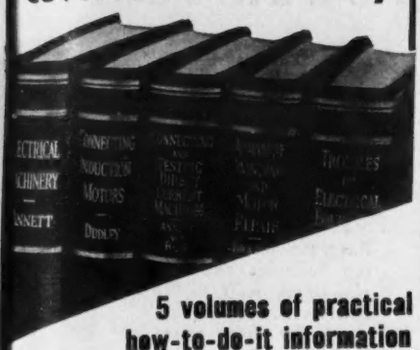

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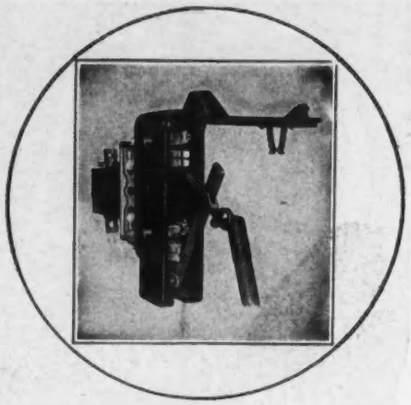
tion on the tangible personal property of the companies. These "tangibles," equipment, poles, wires, tracks, however, would be taxable where located. Baltimore Budget Director Herbert Fallin said that the City of Baltimore would lose taxes up to $500,000 annually under the terms of this bill. He pointed out that much of this tangible property of the corporations is in the adjoining counties and would be added to the assessment books of these subdivisions for taxation under the new set-up. Baltimore's taxable basis would lose from $10,000,000 to $20,000,000 through the change from taxation of capital stock to taxation of tangibles. Titled Senate Bill No. 486, the measure was introduced by Senator James J. Lindsay of Baltimore County and was referred to the committee on finance.

MICHIGAN—A Treasury Department ruling that excess profit taxes on public utilities should not be passed on to consumers was reported recently to the state house committee on public utilities by James H. Lee, assistant Detroit corporation counsel and Richard A. Sullivan, Detroit public utility consultant. Mr. Lee stated that "this important ruling reinforces our request for enactment of the Nagel-Kronk bill, which would permit the state to adjust utility rates downward so that excess profit taxes need not be paid." At a hearing before the House committee Mr. Lee and Mr. Sullivan suggested that the rate readjustment be given all customers of a utility. The Nagel-Kronk bill, as introduced at the request of the city, proposed to limit the adjustments to farm and residential users. The bill is an aftermath of the city's controversy with the Detroit Edison Co. over $8,000,000 in so-called excess profits last year. The city asked the Michigan Public Service Commission to adjust rates at the time, but the commission ruled that it had authority only over future rates. The Nagel-Kronk measure is intended to grant the additional authority.

MISSOURI—Bill to extend the corporate life of electric co-operatives organized under the state rural electrification act is pending before the House for concurrence in Senate amendments that cut the proposed legal existence of such organization from perpetuity to fifty years. Passage of the bill on the 50-year basis came in the Senate after the defeat of an amendment that would have limited the age of the co-operatives to only thirty years. Under existing laws the co-operatives are chartered for only 25 years.

NEW YORK—Governor Dewey has approved the Whitney bill as chapter 260 laws of 1943, amending paragraph 186-a Tax Law to authorize tax commission to require any utility to file an annual return for emergency tax on utility service, regardless of whether utility is subject to tax.

OHIO—House has passed a bill, permitting utility consumers to appeal to the state Public Utilities Commission for alleged irregular charges against consumers served by extension lines. The Senate utilities committee killed a utilities rate-fixing (Kane) bill, which would have permitted the public utilities commission to value utilities for rate-making purposes on the basis of a certain date (ELECTRICAL WORLD, March 27, page 6). Governor Bricker told the Legislature that the bill was necessary legislation, and the Senate utilities committee may reconsider the measure. The Governor took the position that the state commission's present method of using the reproduction cost of a utility property was unfair both to the consumers and utilities, and that it caused unneces-

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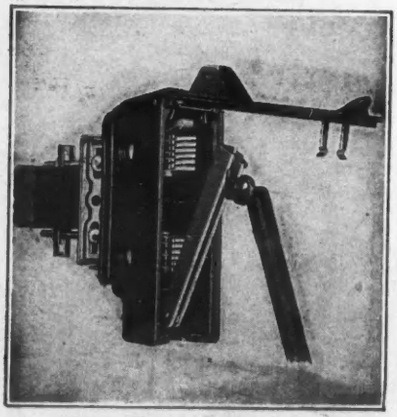

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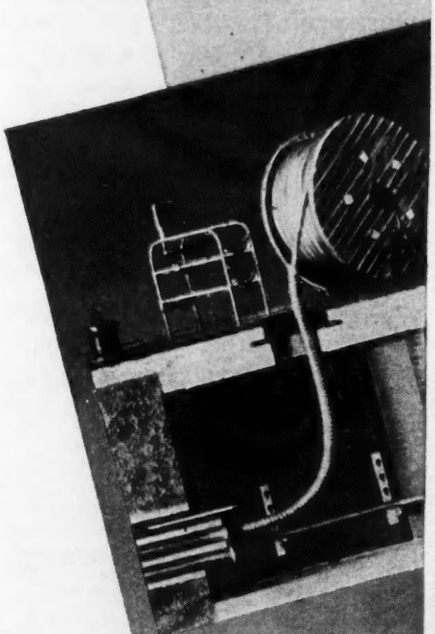

WRITE FOR CATALOG

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sary and expensive delays in fixing rates. Senate taxation committee has voted to end the 0.65 percent utility excise tax December 31, 1944, instead of extending it for a full two-year period until April 30, 1945, as recommended by Gov. John W. Bricker.

WASHINGTON—Legislature completed recently action on a House joint resolution pertaining to control of state waters. The resolution stipulated that "it is the policy of the state of Washington to maintain its jurisdiction and control over the rights of the waters in this state, and to protect such rights as have been established under the laws thereof," and asked "that constituted authorities of this state take such action as may be necessary to resist attempts to invade the rights of this state in the control of the waters of the state." Governor Arthur B. Langlie has signed a bill amending the General Revenue Act, which provides for examption from the sales tax, transactions between utilities on property acquisitions whether by negotiated sale or condemnation.

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## Recent Rate News

ROCKLAND LIGHT & POWER CO's new schedule of reduced rates for electric energy and natural gas sold to its wholly owned affiliate, the Pike County Light & Power Co., Milford, Pa., has been approved by the Federal Power Commission effective as of January 1, 1943. The Rockland utility is located at Nyack, N. Y. The FPC order stated that the new rate schedules, which were filed by Rockland company after several conferences between representatives of the Federal Power Commission, Pennsylvania Public Utility Commission, intervener, and the Rockland Light & Power Co., will result in annual reductions in wholesale charges for electric energy of about $6,800 and of about $500 a year for natural gas, which may be passed on to Pike County's residential customers under an order of the Pennsylvania Public Utility Commission dated February 24, terminating its rate proceedings against Pike County Light & Power Co. and directing the filing of reduced residential rates.

OWENSBORO (KY.) municipal light and water plant customers have filed through their attorneys a suit in Daviess Circuit Court to prevent the transfer of funds from the light and water department to the Board of City Commissioners for general operating purposes. The petition sets out that the plaintiffs are seeking lower light and power rates so that they will cover only operating expenses of the light and water plant. The city receives approximately $200,000 a year from the Light and Water Department.

PARDEEVILLE (WIS.) Electric Light Co. has revised its rates, effecting for about 360 customers a saving of $925 a year, the state Public Service Commission has announced. Of the annual saving, $425 will go to residential customers and $500 to commercial users.

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## Stockholders Increase

Number of General Electric stockholders reached an all-time high of 223,246 on March 12, record date for the dividend to be paid April 26, 1943, W. W. Trench, secretary of the company, has announced. This represents an increase of 3,816 over a year ago.

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# LETTERS TO THE EDITOR

## Resistance Study

*To the Editor of* ELECTRICAL WORLD:

Referring to the article "Resistance Study on a Conduit-Return System" in the March 20, 1943, issue of ELECTRICAL WORLD, Fig. 2 is correctly entitled "Effective Resistance of 100-ft. Lengths of Different Grounded Conductors at 25-deg. C." However, in preparing the cut, ordinates have been labeled "Ohms per 1,000 ft." which is incorrect. The label should have been "Ohms per 100 ft.," as on the blueprint.

EDWARD BENNETT,
Professor of Electrical Engineering
University of Wisconsin, Madison

•

## Transformer Fusing

*To the Editor of* ELECTRICAL WORLD:

It isn't often that I get a giggle out of the ELECTRICAL WORLD, but I got one when I read page 84, Feb. 20 number.

That list of sizes of fuses for transformers of various sizes, at least for the low voltages, is all fol-de-rol. More than 20 years ago I changed the practice on the system on which I was then working, with the unqualified sanction of the operating department, after I had first started a discussion on the question: what is a primary fuse for, protection of the service or protection of the transformer? We decided it was for the protection of the service. Then we adopted the practice of using a fuse that was the maximum capacity of the fuse-block.

The distribution division of the engineering department kept load records and made tests to insure the proper size of transformer, and the change in practice did not increase (to any perceptible extent) the percentage of transformer burn-outs due to overload, but as the transformer fuse would blow only when the transformer burned out, or there was a short circuit on the service wires, the number of blown fuses was materially reduced and the service to customers improved.

DENNEY W. ROPER,
Carmel, Calif.

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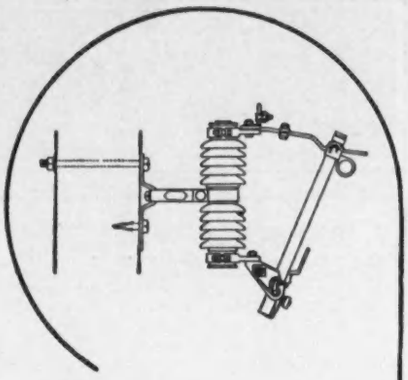
## Plans Stock Redemption

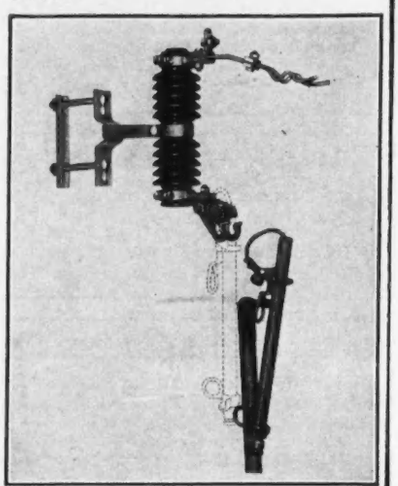
Sylvania Electric Products, Inc., has announced that a proposed call for redemption of all the 4½ percent cumu-

Fuseholders can be easily and safely removed or replaced with standard ballpoint hotsticks.

Fuseholders can't be installed backwards.

Fuseholders won't weld to upper arm during heavy short circuit.



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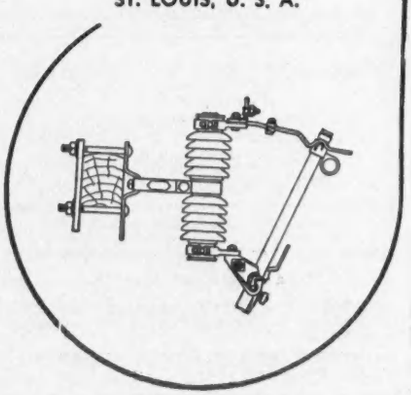

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lative convertible preferred stock outstanding, and an increase in the authorized common stock of the company of 175,000 shares, will be voted on by the stockholders at a special meeting held in Boston this week. In February of this year an announcement by the company indicated that consideration was being given to post-war plans and the setting up of ample reserves for post-war adjustments.

•

## New REA Allotments Total $912,500

Announcement has been made by the Department of Agriculture of the allocation of $912,500 of REA loan funds to twelve systems in ten states. A Minnesota co-operative will acquire 280 miles of line and generating facilities, while allocations to two Ohio systems will finance acquisition of properties ordered sold by the SEC. Five systems received allotments for wiring installations and appliances loans and one for a slaughter room addition to a locker plant.

REA Administrator Harry Slattery said that no new construction will be undertaken except in accordance with authorization or regulation of WPB.

These new funds bring REA allotments to $461,766,465, of which $3,045,550 represents operations during the current fiscal year.

The outstanding allotments among those recently made include:

Minnesota 48 Anoka, Anoka County Co-operative Light and Power Association, Anoka, $383,000, including acquisition of 280 miles (1,147 members), and generating plant of Elk River Power & Light Co.

Ohio 31 Holmes, Holmes Rural Electric Co-operative, Inc., Millersburg, $136,000, including purchase, rehabilitation and integration of 72 miles of line.

Ohio 60 Seneca, North-Central Electric Co-operative, Inc., Attica, $302,000, including purchase, rehabilitation and integration of 141 miles of line.


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3 TIMES FASTER

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- ✓ One man can easily and quickly develop the pressure needed to bend conduit up to 4½ inches.
- ✓ You save cost and time of installing many manufactured bends and fittings.
- ✓ You eliminate expense and delay of cutting and threading nipples.
- ✓ The smooth, even bends made by Greenlee, eliminate wasted time when pulling in wire.
- ✓ The Greenlee, built in one unit, is easily carried to the job and set up and is easier for operator to handle.

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ELECTRICAL CONSTRUCTION ENGINEER—Estimating quantity take off, purchasing, administration. Travel. PW-532, Electrical World, 330 W. 42nd St., New York, N. Y.

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330 W. 42 St., New York City

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Replies invited from men over forty-five.

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(additional For Sale ads on opposite page)

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**HYDRAULIC TURBO-GENERATOR**

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330 West 42 St., New York City

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## D C MOTORS

| P | Make | Type | Volts | Speed |
|---|---|---|---|---|
| 1500 | Whse. | | 550 | 330 |
| 1250 | G.E. | MPC | 550 | 130 |
| 800 | G.E. | MPC | 600 | 300 |
| 625 | G.E. | MPC | 500 | 120 |
| 600 | G.E. | MPC | 600 | 650/900 |
| 600 | Whse. | | 250 | 150/275 |
| 350 | G.E. | MPC | 220 | 450 |
| 300 | G.E. | DMC | 230 | 400/600 |
| 300 | Cr. Wh. | CMC | 230 | 1150 |
| 300 | G.E. | MPC | 230 | 275/550 |
| 270 | Whse. | | 500 | 250/400 |
| 250 | Al. Ch. | | 230 | 525 |
| 200 | Whse. | | 230 | 400 |
| 175 | Whse. | SK | 250 | 150/525 |
| 150 | G.E. | RC-10A | 230 | 800/1000 |
| 150 | Whse. | SK-201 | 230 | 300/900 |
| 150 | G.E. | MPC | 220 | 250/450 |
| 125 | G.E. | CO-1832 | 230 | 625 |
| 120 | Whse. | SK-180 | 230 | 730 |
| 100 | G.E. | LC-50 | 230 | 1200 |
| 100 | Al. Ch. | | 230 | 950/1150 |
| 100 | G.E. | RC-19 | 230 | 575/720 |
| 75 | G.E. | LC | 220 | 500/1000 |
| 75 | Whse. | SK | 230 | 475/900 |
| 60 | El. Dy. | 25S | 220 | 525/1050 |
| 50/60 | Cr. Wh. | 65H | 230 | 500/1000 |
| 50 | G.E. | RC-16 | 230 | 650/815 |

## TRANSFORMERS

| KVA | Make | PH | Type | Voltages |
|---|---|---|---|---|
| 1000 | Pitts. | 1 | OISC | 2300/4600x575 |
| 1000 | G.E. | 1 | HKDD | 13800x2300 |
| 500 | G.E. | 1 | H | 13200x2300/575 |
| 200 | Whse. | 1 | SK | 6900x230/460 |
| 200 | G.E. | 1 | H | 26400x115/460 |
| 100 | Whse. | 1 | OISC | 13200x |

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720 HP DeLaval 3600/600 RPM.

## MOTOR GENERATOR SETS

### 3 ph. 60 cycle

1—1500 KW GE 600 V. DC, Gen. dc. to 2100 HP—6600 V. Syn. Motor with exciter.
1—500 KW GE 600 V. DC Gen. d.c. to 700 HP—2200/13200 V. Syn. Motor with Exciter.
2—250 KW GE 250 V. Gen. d.c. to 375 HP—2200 V. Syn. Motor.

### TURBO GENERATOR SET

1—500 KW, Whse. 625 Kva., 440 V., 3 ph., 60 cy., 3600 RPM with Parsons 145/175 lb. condensing turbine complete with jet condenser and accessories.
1—500 KW, G.E., 625 KVA, 2300 V., 3 ph., 60 cy. generator with Curtis 4 stage, 150 pound condensing turbine complete with condenser, etc.

### ROTARY CONVERTERS

#### 60 cycle

2—1500 KW, Whse. 720 RPM 650 V. DC with 3-single phase, 23000 V. transformers and panel.
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2—750 KW, Whse. 1200 RPM, 600 V. DC with 2300/6600/11,000 volts Transformers and Panels.
1—750 KW, Whse. 720 RPM 250 V. DC with three phase 6600/2300 V. Transformer and Panels.
1—375 KW, Whse. 1200 RPM 250/275 V. DC with 2200/6600 V. Transformers and Panels.
1—300 KW, G.E., type HCC, 1200 RPM, DC, 600 V. AC 6 ph., 1200 RPM.

#### 25 cycle

3—1500 KW, G.E. 225/275 V. DC Booster type each with 1600 KVA, 3 ph. 6765 volt Tranformers and Panels.
1—500 KW, G.E. 225/275 DC Booster type with 500 KVA 3 ph. 6765 volt Tranformer and Panels.

## A. C. MOTORS

**3 phase—60 cycles**

### Synchronous

| | HP | Make | Type | Volts | Speed |
|---|---|---|---|---|---|
| 1— | 500 | G.E. | TS | 440 | 360 |
| 1— | 250 | G.E. | ATI | 220 | 450 |
| 1— | 225 | G.E. | ATI | 240 | 600 |
| 1— | 200 | Whse. | | 440 | 514 |
| 1— | 150 | G.E. | TRB | 220x440 | 450 |
| 1— | 150 | Whse. | G | 2300 | 900 |
| 1— | 150 | Whse. | | 2200/550 | 1800 |
| 1— | 125 | G.E. | ATI | 240 | 257 |

### Slip Ring

| | | | | | |
|---|---|---|---|---|---|
| 1— | 800 | Al. Ch. | | 440 | 885 |
| 1— | 600 | G.E. | IM | 2200 | 900 |
| 1— | 450 | Whse. | CW | 2200 | 875 |
| 1— | 400 | G.E. | MT | 550/440 | 300 |
| 1— | 400 | Al. Ch. | | 2300 | 505 |
| 1— | 400 | Al. Ch. | | 440 | 1200 |
| 1— | 350 | G.E. | IM | 2300/4000 | 257 |
| 1— | 300 | G.E. | IM | 2300 | 585 |
| 1— | 250 | G.E. | MT-410 | 2300 | 400 |
| 1— | 250 | G.E. | MT | 4000/2300 | 257 |
| 2— | 200 | Whse. | CW | 2200 | 514 |

### Squirrel Cage

| | | | | | |
|---|---|---|---|---|---|
| 1— | 500 | G.E. | 1-17B | 2200 | 695 |
| 1— | 300 | Whse. | CS | 550 | 580 |
| 2— | 300 | G.E. | 1K | 2300 | 600 |
| 1— | 300 | Al. Ch. | | 2200 | 1160 |
| 1— | 250 | Al. Ch. | | 220/440 | 1150 |

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Main unit—GE 3 unit, 4 Brg. consisting of motor—15/35 HP. 750/1800 RPM. 230 V. DC Gen—15 KW—220/110 V., 1800 RPM—3 ph., 60 cy.
Ref. Gen.—5 KW—36/18 V., 1800 RPM, 3 ph., 60 cy., with stator shifting.
Complete with Exciter Set, Voltage regulator, panels and accessories.

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1—35 KW, 125 Volt, Electric Machinery sq. cage.
1—20 KW, 600 Volt, General Electric, sq. cage.

### MOTOR—3 PHASE 60 CYCLE

1—720 HP, 360 RPM, 440 volt, G.E., syn.
1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E. syn.
1—300 HP, 720 RPM, 2200 volt, G.E., sl. rg.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., sync.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v. G.E., sl. rg.
1—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
2— 75 HP, 1200 RPM, 2200 volt, G.E., vertical.

### MOTORS—D. C. 230 VOLTS

2—450 HP, 400 RPM, General Electric MPL.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, 550 RPM, Westinghouse, SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1— 65 HP, 1000 RPM, G.E., type RC.
1— 50 Hp. RPM, Westinghouse, type SK.

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3—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E. 33,000 2300/4000 Y.
1—150 KVA, G.E., 2400-120/240 volts.
2—450 HP, G.E., 400 RPM, type MPL.
2—150 HP, Westinghouse, 550 RPM, type SK.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
1—100 KVA, G.E., 2200-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.

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2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—60 HP, 600/1200 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.

### ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—400 KVA, 400 RPM, 240 volt, Westg.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chalmers

### TURBO-GENERATORS

600 KW, Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW G.E., 3 ph., 60 cy., 220 volt, cond.

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1—150 KVA, General Electric Generator, Ames uniflow engine.
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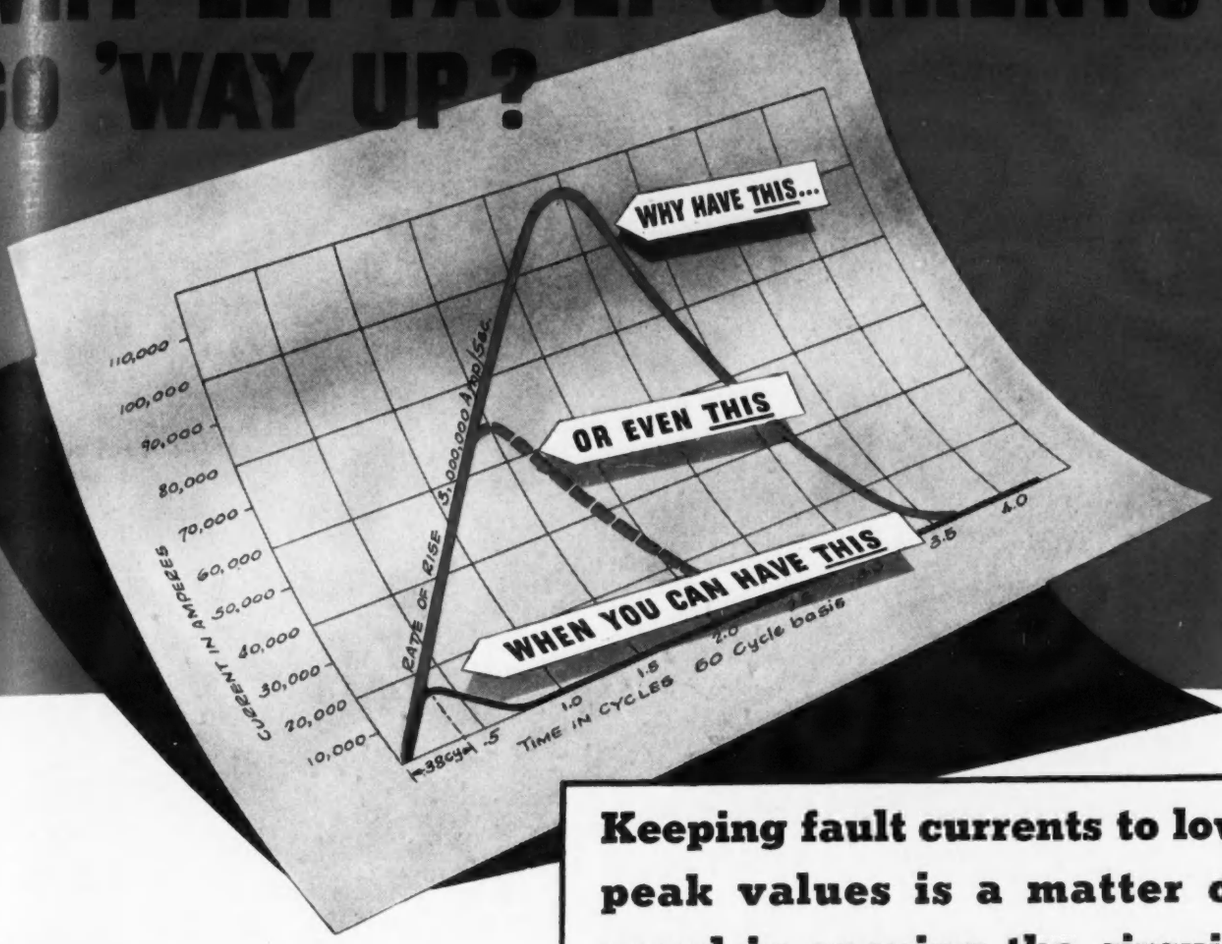
★ **These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference**

d-c motor drives and M-G sets connected in parallel...

# WHY LET FAULT CURRENTS GO 'WAY UP?




**Keeping fault currents to low peak values is a matter of speed in opening the circuit.**

**WHEN** A FAULT OCCURS on a d-c circuit in which generators, converters or rectifiers are connected in parallel to feed large motor drives, the rate of current rise is extremely rapid. Rates of the order of several million amperes per second are not uncommon.

With such rates of rise, conventional circuit breakers designed to open in 3 cycles, or even in 1½ cycles, must be built to withstand the effects of the high currents encountered. Bus structures must be of ample conducting material and must be heavily braced.

## SAVE MATERIALS

But rapidly rising currents can be interrupted much more quickly. The current can be limited in a period of the order of .38 cycle. Under such quick-opening conditions, materials in the system can be much lighter; bracing of buses much simpler.

## SAVE MACHINES

Slow opening gives time for a flash-over to damage brushes and brush-holders. Fast opening saves them; saves manpower and time used in repairs or replacements and, in these times, saves machines for productive service when replacement parts are not available.

## HIGH-SPEED CIRCUIT BREAKERS HAVE PROVED THEIR VALUE

I-T-E has high-speed circuit breakers in service. They are new but their record is well-founded. Our engineers will gladly tell you about them.

I-T-E

**AIR SWITCHGEAR**

IMMERSED IN AIR • ENCASED IN STEEL

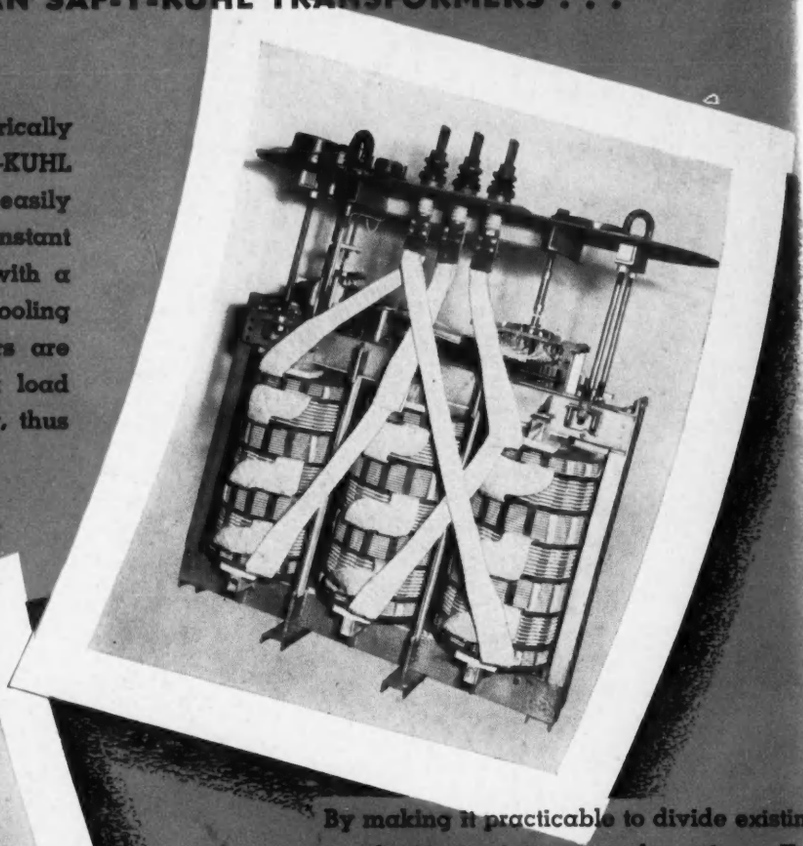
*Representatives in Principal Cities*

**CIRCUIT BREAKER CO., PHILADELPHIA, PA.**

# Three Views

## THAT HELP TO SHOW YOU THE RUGGED CONSTRUCTION OF KUHLMAN SAF-T-KUHL TRANSFORMERS . . .

From its rugged steel frame to its electrically reinforced end coils, a Kuhlman SAF-T-KUHL Transformer is designed and built to easily withstand the stress and strain of constant heavy loads. Because they are filled with a non-inflammable, non-explosive, inert cooling fluid Kuhlman SAF-T-KUHL Transformers are 100% safe. They may be installed at load centers even on beams near the ceiling, thus saving floor space.



By making it practicable to divide existing electrical circuits into several sections, Kuhlman SAF-T-KUHL Transformers result in reduced power losses, and better voltage regulation. In addition, they reduce maintenance costs because SAF-T-KUHL fluid does not require periodic conditioning.

It will pay you to write for complete facts about the many advantages of SAF-T-KUHL Transformers as well as Kuhlman Power, Distribution, C.S.P. and Dry Type Transformers and Line Regulators.

**Kuhlman** ELECTRIC COMPANY • BAY CITY, MICHIGAN